

## CHAPTER 4

### ECONOMIC IMPACT METHODOLOGY

This section provides a brief overview of the methodology used in the economic impact, regulatory flexibility, and environmental justice analyses. The discussion follows the sequence from the smallest scale (costs for specific configurations of option, subcategory and site) to the largest scale (market analysis):

- # cost annualization model, Section 4.1
- # site closure model, Section 4.2
- # community and national impacts, Section 4.3
- # corporate financial distress, Section 4.4
- # market model, Section 4.5

The results of these analyses are located in Chapter 6.

#### 4.1 COST ANNUALIZATION MODEL

The beginning point for all analyses is the cost annualization model, see Figure 4-1. Inputs to the cost annualization model come from three sources—EPA’s engineering staff, secondary data, and the 1997 EPA Survey. The capital, one-time non-equipment<sup>1</sup>, and operating and maintenance (O&M) costs for incremental pollution control were developed by EPA’s engineering staff. The capital cost, a one-time cost, is the initial investment needed to purchase and install the equipment. The one-time non-equipment cost is incurred in its entirety in the first year of the model. The O&M cost is the annual cost of operating and maintaining the equipment; it incurred by the site each year.

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<sup>1</sup>A one-time non-equipment cost is best explained by example, such as an engineering study that recommends improved operating parameters as a method of meeting effluent limitations guidelines. One-time non-equipment costs cannot be depreciated because the product is not associated with property that wears out, nor is it an annual expense.

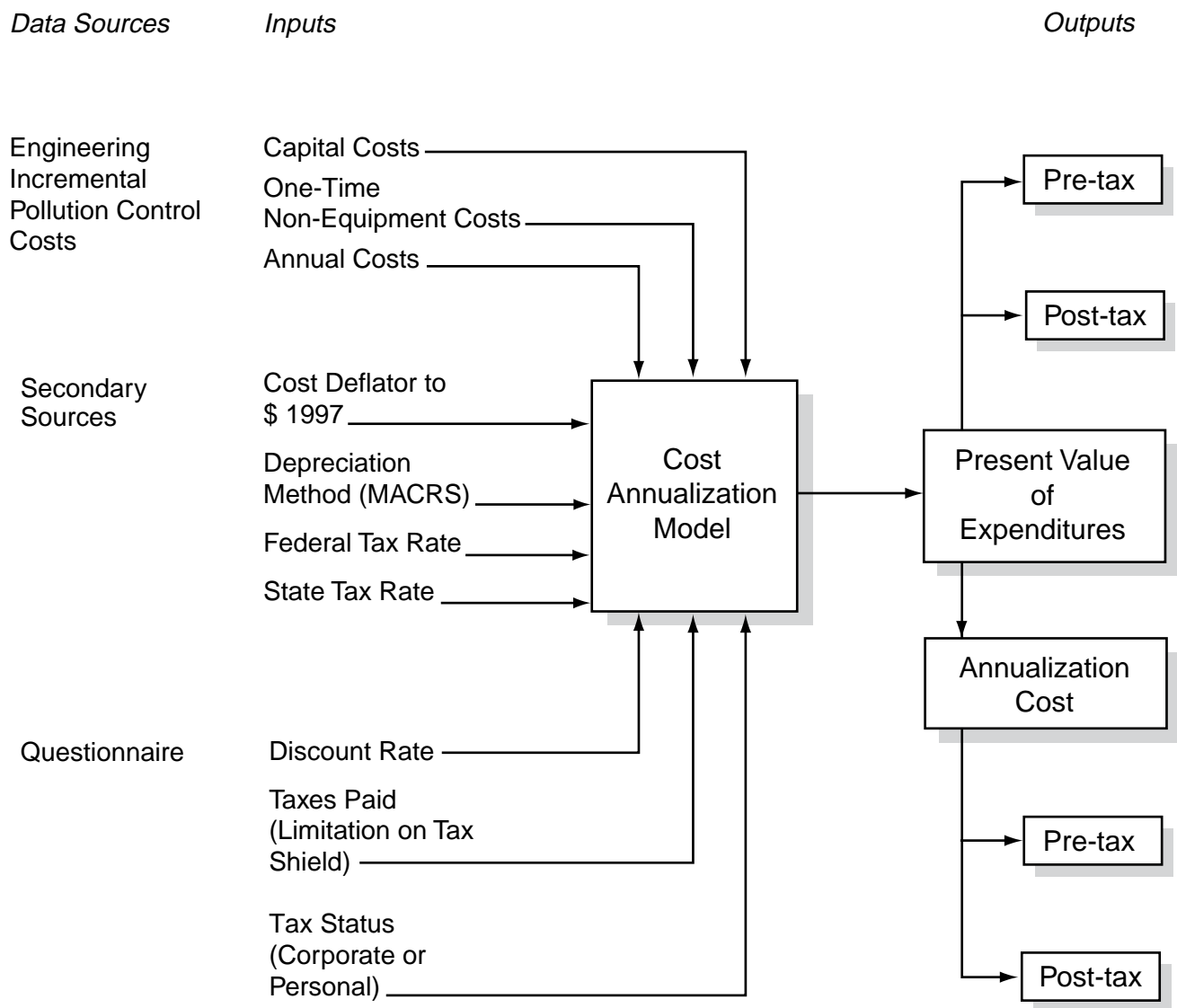


Figure 4-1  
Cost Annualization

There are two reasons for the annualization of capital, one-time non-capital, and O&M costs. First, the capital cost is incurred only once in the equipment's lifetime; therefore, initial investment should be expended over the life of the equipment. The Internal Revenue Code Section 168 classifies an investment with a lifetime of 20 years or more but less than 25 years as 15-year property. The cost annualization model uses a 15-year depreciable lifetime for the capital cost. Second, money has a time value so expenditures incurred at the end of the equipment's lifetime or O&M expenses in the future are not the same as expenses paid today. A mid-year depreciation convention is used; i.e., an assumption of a six-month period between purchase of equipment and time of operation. As such, the model covers a 16-year period with a six month period in the first year and a six month period in the sixteenth year.

Secondary data provides the average inflation rate from 1987 to 1997 as measured by the Consumer Price Index. The depreciation method used in the cost annualization model is the Modified Accelerated Cost Recovery System (MACRS). MACRS allows businesses to depreciate a higher percentage of an investment in the early years and a lower percentage in the later years. The average inflation rate is used to convert the nominal discount rate to the real discount rate. Tax rates are determined by the national average state tax rate plus the Federal tax rate.

The 1997 EPA Survey data provides discount rate or interest rate (the weighted average cost of capital or the interest rate supplied by the site). If the site supplied neither a discount rate nor an interest rate EPA assigned the median discount rate of all sites for this value. Taxable income, or earnings before interest and taxes (EBIT), is also supplied by the EPA Survey. The value of EBIT determines the tax bracket for the site. Average taxes paid is calculated from EPA Survey data using taxes for the years 1995, 1996, and 1997. The model ensures that the tax shield cannot be greater than the average taxes paid in these years. Corporate structure estimates tax shields. A C corporation pays federal and state taxes at the corporate rate, an S corporation or a limited liability corporation pays taxes at the individual rate (since EPA has no way of determining how many individuals receive earnings or their tax rates, these rates are set to zero), and all other entities pay taxes at the individual rate.

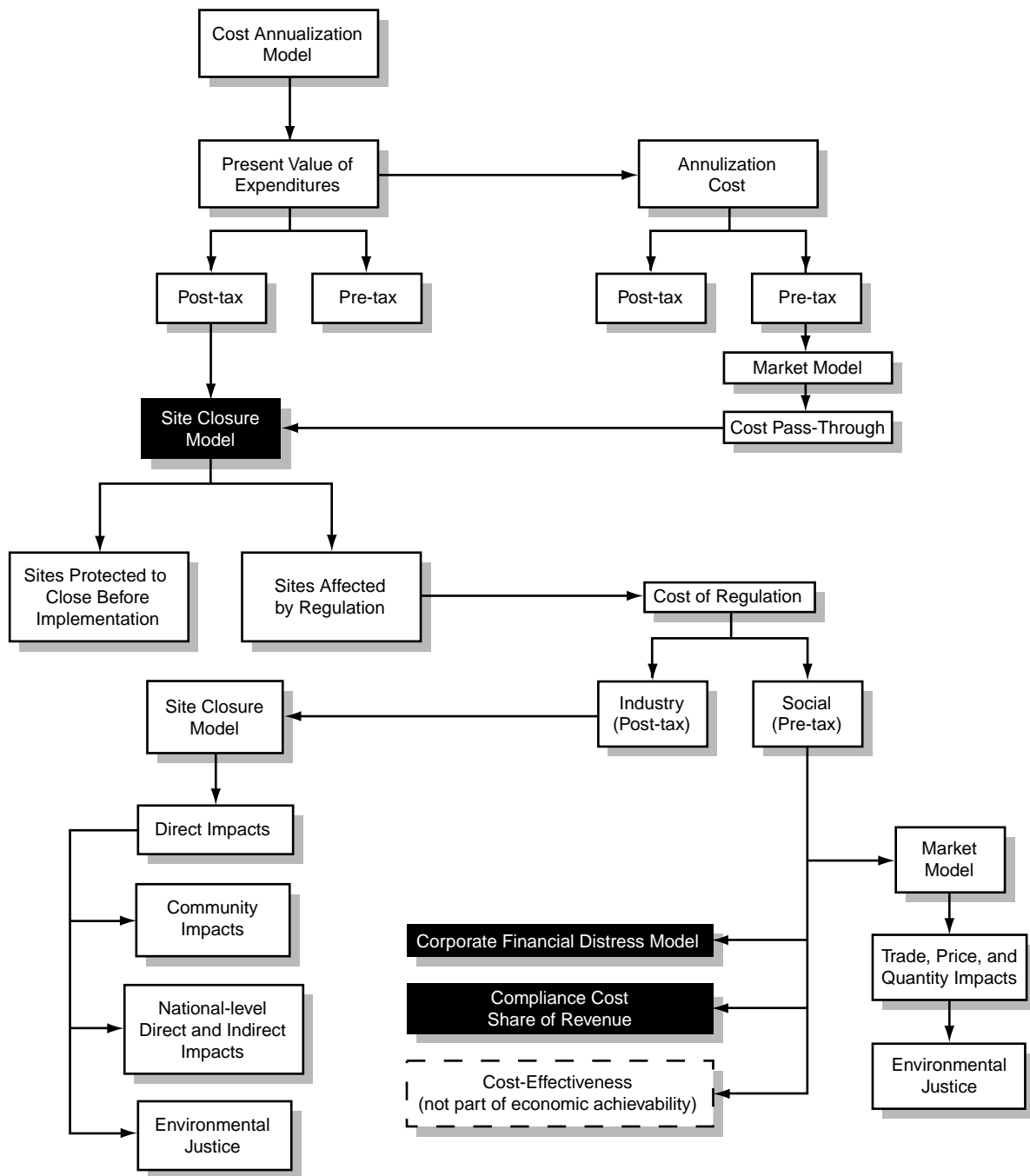
A sample cost annualization spreadsheet is located in Appendix A of this document. Section A.3 of Appendix A describes the calculations used to determine annualized costs (before and after taxes) and present value of costs (before and after taxes) in detail.

The cost annualization model calculates the present value of the pre- and post-tax cost streams. Then it calculates the annualized cost based on the site-specific discount rate. Thus, the model calculates four types of compliance costs for each site: present value of expenditures (pre- and post-tax) and annualized cost (pre- and post-tax). The latest year for which financial data is available is 1997, hence, the model uses 1997 dollars.

The cost annualization model outputs feed into the other economic analyses, see Figure 4-2. From top to bottom, the pre-tax annualized cost for all sites costed provides an initial estimate of the shock to the market model (Section 4.5). An output of the market model is an estimate of the percentage of increased costs that a producer could pass to its customers. The post-tax present value and the cost-pass-through factor are inputs to the site closure model (Section 4.2). The results of the site closure model allow EPA to identify sites with complete site-level data and no confounding factors (e.g., start-up site, captive site, or unusual ownership such as joint entity or foreign ownership) projected to close before the regulation is implemented. The site closure model also identifies sites projected to close as a result of the regulation. Direct, regional, and national-level direct and indirect impacts flow from the sites projected to close (Section 4.3). The pre-tax costs are inputs to the corporate financial distress model (Section 4.4), compliance cost share of revenue, and as a refined estimate of the shock to the market model. Pre-tax costs also figure in the cost-effectiveness analysis (see Appendix C; not part of economic achievability).

## **4.2 SITE CLOSURE MODEL**

EPA developed a financial model to estimate whether the additional costs of complying with the proposed regulation rendered an iron and steel site unprofitable. If so, the site is projected to close as a result of the regulation, leading to site-level impacts such as losses in employment and revenue. Hence, the site financial model is also called the closure model within the report. The model is based on site-specific data from the detailed questionnaire (U.S. EPA, 1998) because such data are not available elsewhere.




 Small Business Analyses

Figure 4-2

Interrelationship Among Cost Annualization and Other Economic Analyses

In terms of perspective, the closure model focuses on the site. It attempts to answer the question “does it make financial sense to upgrade this site?” using data and methodology available to corporate financial analysts. The closure model interacts with the market model (Section 4.5); the latter estimates the industry proportion of costs that the steel manufacturer passes through to its customers via price increases. In contrast, the corporate financial distress model evaluates whether a company could afford to upgrade all of its facilities (Section 4.4). In other words, each model provides a different perspective on the industry and the impacts potentially caused by the effluent limitations guidelines requirements.

The model turns the question “does it make sense to upgrade this site?” into a comparison of future cash flows with and without the regulation. The closure decision is modeled as:

$$\begin{aligned} \text{Post-regulatory status} &= \text{Present value of future earnings} \\ &- (\text{Present value of after-tax incremental pollution control costs} \\ &\quad * (1\text{-percent cost pass-through})) \end{aligned}$$

The model calculates the long-term effects on earnings reduced by the added pollution control costs. If the post-regulatory status is less than zero, it does not make economic sense for the site owner to upgrade the site. Under these circumstances, the site is projected to close.<sup>2</sup> Although simple in concept, the model incorporates numerous choices, including:

- # Whether or not to include salvage value
- # Net income or cash flow for the basis of projecting future earnings
- # Time frame for consideration

Section 4.2.1 reviews the decisions and their bases for the steel site financial model. Section 4.2.2 describes the data preparation and forecasting methods used in this analysis. Section 4.2.3 presents EPA’s methodology for determining site closure when evaluating multiple approaches for estimating future earnings.

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<sup>2</sup> When a site is liquidated, EPA assumes that it no longer operates and closure-related impacts result. In contrast, facilities that are sold because a new owner presumably can generate a greater return are considered *transfers*. Transfers cause no closure-related impacts, even if the transfer was prompted by increased regulatory costs. Transfers are not estimated in this analysis.

## 4.2.1 Assumptions and Choices

### 4.2.1.1 Salvage Value

The closure decision equation can be modified to include consideration of the salvage value of the site. That is, the post-regulatory status is zero if the present value of post-regulatory earnings *exceeds the salvage value of the site*.

For the iron and steel industry, however, EPA determined that it was not appropriate to include salvage value in the site financial model. First, individual pieces of equipment tend to be designed for specific sites due to their scale. Because it is highly unlikely that individual components of a site could be sold, there is no market value to fixed assets.<sup>3</sup> An exception is if the entire plant could be transferred to a new location, as was done for Tuscaloosa Steel. In these cases, the salvage value is still zero because the owner paid to break down, transport, and re-assemble the site elsewhere. Second, it is not appropriate to calculate a salvage value based solely on current assets because the value of cash, cash-equivalents, and inventory are sufficiently liquid that the owner would not base a long-term decision on them. (That is, an owner would not liquidate the site because it shows a relatively high cash position on the balance sheet. The cash could be transferred to other corporate operations without such a drastic step as closing down operations.)

Third, excluding salvage value brings the site financial model into greater consistency with econometric modeling approaches. That is, a site is assumed to remain in operation as long as its revenues meet or exceed its operating costs. Sunk—i.e., capital—costs are not considered.

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<sup>3</sup>Bethlehem Steel, for example, could have torn down everything at its home town location along the Lehigh River but chose to develop part of the site into an industrial museum (Wright, 1999). Liquidating part or all of the site was not mentioned as a possibility.

#### ***4.2.1.2 Net Income Versus Cash Flow***

EPA examined two alternatives for estimating the present value of future plant operations:

- # Net income from all operations, calculated as revenues less operating costs; selling, general, and administrative expenses; depreciation; interest; and taxes (as these items are recorded on the site's income statement).
- # Cash flow, which equals net income plus depreciation.

Depreciation reflects previous, rather than current, expenditures and does not actually absorb incoming revenues. Brigham and Gapenski, 1997 note that—in capital budgeting—it is critical to base decisions on cash flows or the actual dollars that flow into and out of the company during the evaluation period. The Financial Accounting Standards Board, in SFAS Nos. 105, 107 and 119 recommends the present value of future cash flows as a means of identifying market value (FASB, 1996). EPA, therefore, selected cash flow as the basis for measuring the present value of future site operations.

#### ***4.2.1.3 Time Frame for Consideration***

EPA uses a 16-year time period for forecasting future income to correspond to the time period used in the cost annualization model (see Appendix A). Although it might be appropriate to use the estimated actual lifetime of the equipment rather than the depreciation period, the extended lifetime results in a lower estimated annualized cost because of the greater number of years over which to spread the capital investment. EPA preferred to use the more conservative (shorter) time frame. The first year's data are not discounted, again to keep the cost annualization and forecasting projections on a consistent basis.

## 4.2.2 Present Value of Future Earnings

### 4.2.2.1 *Adjusting Questionnaire Data for Projections*

#### **Adjusting Earnings to an After-Tax Basis**

Depending on the corporate hierarchy for the site, the earnings reported in the questionnaire may have to be adjusted for taxes. A site may fall into one of several categories:

- # It is part of a multi-site corporation. Site earnings before interest and taxes (EBIT) are adjusted to an after-tax basis according to the taxable income of the business entity using the appropriate corporate tax rate.
- # It is part of a multi-site organization whose income is taxed at the rate for individuals (e.g., partnerships, sole proprietorships, etc.). Site earnings before interest and taxes (EBIT) are adjusted to an after-tax basis according to the taxable income of the business entity using the appropriate individual tax rate.
- # The site is, or is part of, an S Corporation or Limited Liability Corporation.
- # The site is the business entity; therefore, the complete income statement data is supplied for the site. Because net income is presented on an after-tax basis, no adjustments need to be made. These facilities have corporate hierarchy type "F" in the detailed questionnaire. For sites that received the short form, the site was presumed to be the business entity if the data for the site and company were identical.
- # The site has a foreign owner. In these cases, the business entity information is not appropriate to use because GAAP may differ from country to country. These sites are treated as if they were independent companies, i.e., the site is the business entity.

#### **Adjusting Earnings to After-Tax Cash Flow**

For the first two categories (multiple facilities under the same ownership), cash flow is calculated as:

$$\text{Cash Flow} = [(\text{EBIT}) * (1 - (\text{federal} + \text{state tax rates}))] + \text{depreciation}$$

where the federal and state tax rates are dependent on corporation type and income at the business entity level, see Section A.1 for more details. That is, EPA reduces operating earnings by estimated taxes. EPA

does not make a similar adjustment for interest because interest is generally not held at the site level and it may vary widely from company to company (while tax rates are consistent).

S corporations and limited liability corporations (the third category) do not pay taxes. They distribute income to the partners and tax is paid by the partners at each partner's personal tax level. (That is, the company doesn't pay taxes, the partners pay taxes.) Therefore, no adjustment is needed.

For the fourth and fifth categories—single site businesses, cash flow is calculated as:

$$\text{Cash flow} = \text{net income} + \text{depreciation}$$

#### ***4.2.2.2 Forecasting Methods for Future Cash Flow***

Site cash flow must be forecast over the 16-year project lifetime. All forecasting methods examined for and used in the closure analysis incorporate the following assumptions and procedures:

- # No growth in real terms.
- # Constant 1997 dollars. Data from 1995 and 1996 are inflated using the change in the Consumer Price Index (CEA, 1999).

The "no growth" assumption is made so that a site is not assumed to grow its way out of an economic impact associated with additional pollution control costs; essentially, sites are assumed to be running at or near capacity and significant growth is assumed to be unlikely without a major capacity addition.

Section 2.10 indicates that earnings in the steel industry sometimes show pronounced year-to-year variations as well as an underlying cyclicity, see Figure 2-10. Table 4-1 summarizes AISI data for industry cash flow from 1986 through 1998 (AISI, 1998). The cash flows are adjusted to 1997 dollars via the Consumer Price Index (CPI). The last column in the table calculates the ratio of the cash flows to the 1997 value. The scaling factors are used in the forecasting model to adjust each site's earnings to the projected value. The estimate for 1999 is based on the ratio of operating earnings for the first six months of 1999 and 1998 multiplied by the change from 1997 to 1998 (AISI, 2000).

**Table 4-1****Cash Flow (in millions) and Scaling Factors**

Year	Cash Flow (\$current)	CPI	Cash Flow (\$1997)	Scaling Factor (base=1997)
1986	(\$2,849)	109.6	(\$4,172)	-1.51
1987	\$2,371	113.6	\$3,350	1.21
1988	\$744	118.3	\$1,009	0.37
1989	\$2,916	124.0	\$3,775	1.37
1990	\$1,391	130.7	\$1,709	0.62
1991	(\$756)	136.2	(\$890)	-0.32
1992	(\$2,633)	140.3	(\$3,012)	-1.09
1993	\$3,402	144.5	\$3,779	1.37
1994	\$2,849	148.2	\$3,085	1.12
1995	\$3,170	152.4	\$3,338	1.21
1996	\$2,106	156.9	\$2,155	0.78
1997	\$2,759	160.5	\$2,759	1.00
1998	\$2,714	163.0	\$2,673	0.97
1999				0.06

Sources: AISI, 1998; CEA, 1999; BLS, 2000a; and AISI, 2000.

EPA examined several different forecasting methods to address site-specific variations:

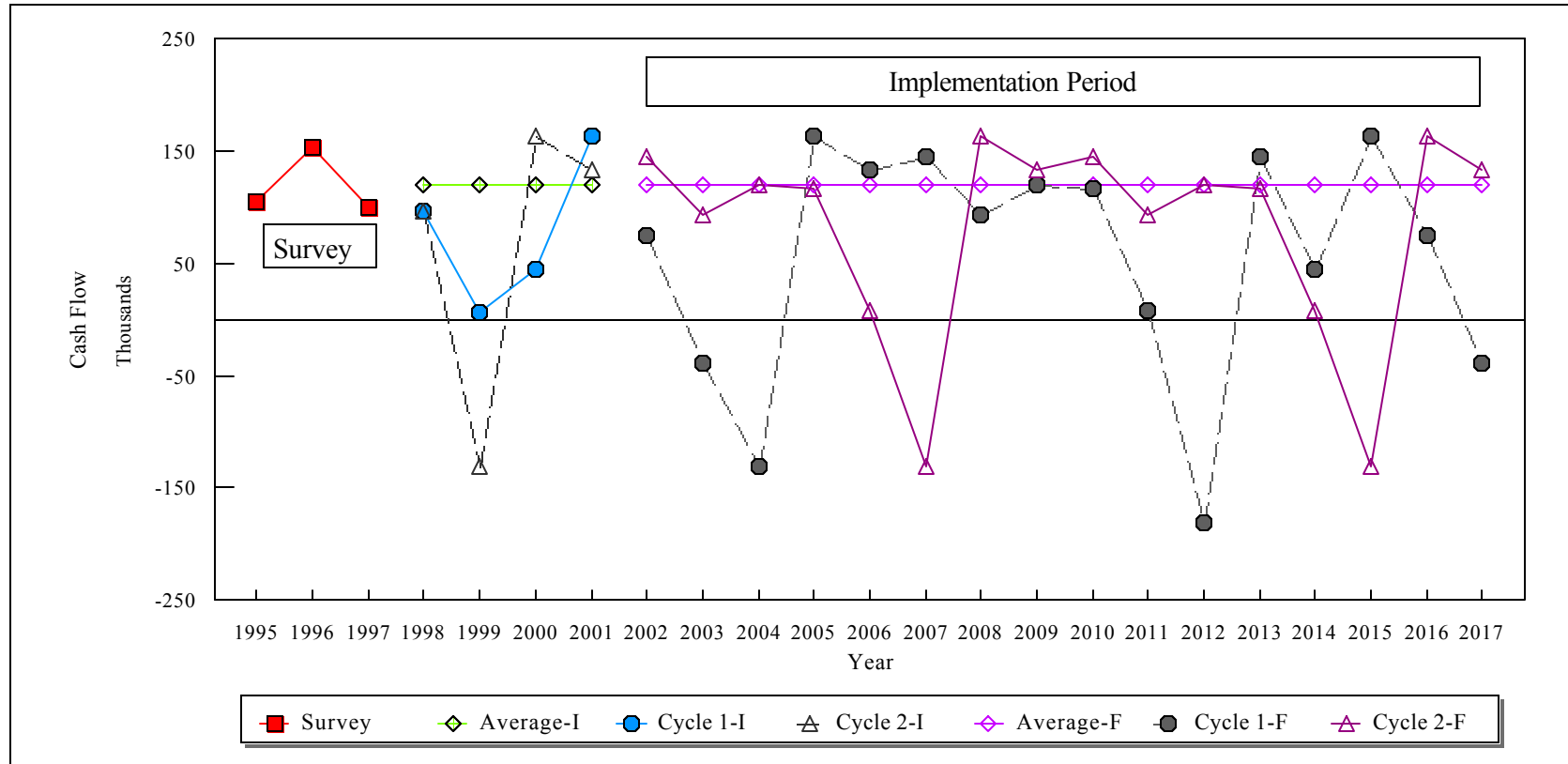
- # Three-year average (1995 through 1997) as best indicator of future cash flow.<sup>4</sup> This approach provides an “upper bound” because those three years were healthy (see Figure 4-3) and it does not include the 1998 and 1999 downturn.
  
- # Time-varying cash flow (called “Cycle 1”)
  - 1995 = 1995 cash flow
  - 1996 = 1996 cash flow
  - 1997 = 1997 cash flow
  - 1998 = Three-year average cash flow \* 1998 industry adjustment
  - 1999 = Three-year average cash flow \* 1999 industry adjustment
  - 2000 = Three-year average cash flow \* 1988 scaling factor
  - 2001 = Three-year average cash flow \* 1989 scaling factor, etc.
  - 2012 = Three-year average cash flow \* 1986 scaling factor, etc.
  
- # Time-varying cash flow (called “Cycle 2”)
  - 1995 = 1995 cash flow
  - 1996 = 1996 cash flow
  - 1997 = 1997 cash flow
  - 1998 = Three-year average cash flow \* 1998 industry adjustment
  - 1999 = Three-year average cash flow \* 1999 industry adjustment
  - 2000 = Three-year average cash flow \* 1992 scaling factor
  - 2001 = Three-year average cash flow \* 1993 scaling factor, etc.
  - 2007 = Three-year average cash flow \* 1992 scaling factor, etc.

Figure 4-3 illustrates the different forecasting methods. The section of data on the left-hand side of the graph shows the actual 1996-1997 cash flow. The period from 1998-2001 is the rulemaking period and the forecasting methods begin. Promulgation is scheduled for 2002; this is taken as the first year of implementation and the beginning of the 16-year period over which to consider the impact on earnings. The straight line is the average earnings. Cycle 1 assumes that the second half of 1999 is no worse than the first half. The industry follows the 1988-1999 pattern with a short recovery, a decline over three years, a rapid recovery (see 1992-1993), and a period of slow decline. Cycle 1 has the rule going into effect just as the industry is hitting a downturn. Within the 16-year period, there are three years with net industry negative cash flow. With its pessimistic assumptions, Cycle 1 is a counterbalance to the three-year average forecasting method.

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<sup>4</sup>EPA requested three years of data in the questionnaire to mitigate the uncertainty in the analysis resulting from a single datum point. For new or newly-acquired facilities, however, one year of data may be all that is available for analysis. For facilities with a trend in income, the most recent year may be the more conservative estimate of future cash flow. If only two years of data are available, the model calculates the average of the two values. If only 1997 data are available, that year's data is used.

**Figure 4-3**  
**Forecasting Methods**



Cycle 2 assumes that the decline continues throughout 1999 and looks like 1992; the year in which trade cases were also filed. Cycle 2 used the scaling factors for the 1992-1999 period (an eight-year cycle). It incorporates the assumption that the industry learned from its 1989-1992 experience and will file trade cases rapidly once it determines that imports play an important role in the downturn. Cycle 2 has the effect of the industry hitting an upturn when the rule is promulgated. Within the 16-year period, there are two years with net industry negative cash flow. Cycle 2 projections, then, lie between the three-year average and Cycle 1 projections.

#### ***4.2.2.3 Discount Rate***

The final step in estimating each site's preregulatory present value is to discount the cash flow stream back to the first year in the time series. This step does not adjust the stream for inflation because the projections are in constant dollars. Thus, the discount rate used for discounting must be a real discount rate, obtained by adjusting the nominal discount rate for the expected annual rate of inflation (see Appendix A). The same site-specific real discount rate is used in both the cost annualization and closure models.

#### **4.2.3 Projecting Site Closures As A Result Of The Rule**

With three forecasting methods, there are three ways to evaluate a site's status. If a site's post-regulatory status is less than zero, the site is assigned a score of "1" for that forecasting method. A site, then, may have a score ranging from 0 to 3.

Closure is the most severe impact that can occur at the site level and represents a final, irreversible decision in the analysis. The decision to close a site is not made lightly; the business is aware of and concerned with the turmoil introduced into its workers' lives, community impacts, and how the action might be interpreted by stockholders. The business will likely investigate several business forecasts and several methods of valuing their assets. Not only all data, assumptions, and projections of future market behavior would be weighed in the corporate decision to close a site, but also the uncertainties associated with the projections. When examining the results of several analyses, the results are likely to be mixed. Some indicators may be negative while others indicate that the site can weather the current difficult situation. A

decision to close a site is likely to be made only when the weight of evidence indicates that this is the appropriate path for the company to take.

EPA emulated corporate decision-making patterns when determining when a site would close. A score of 1 may result from an unusual year of data. When the score is 2 or 3, however, EPA deemed that weight of the evidence now indicates poor financial health. EPA believes that this scoring approach represents a reasonable and conservative method for projecting closures.

#### ***4.2.3.1 Pre-Regulatory Conditions***

The closure analysis begins with an evaluation of the pre-regulatory status of each site. Several conditions may lead to a site having a score of 2 or 3 under pre-regulatory conditions:

- # The company does not record sufficient information at the site-level for the closure analysis to be performed.
- # The company does not assign costs and revenues that reflect the true financial health of the site. Two important examples are cost centers and captive sites, which exist primarily to serve other facilities under the same ownership. Captive sites may show revenues, but the revenues are set approximately equal to the costs of the operation. (Cost centers have no revenues assigned to them).
- # The site appears to be in financial trouble prior to the implementation of the rule.

Under the first two conditions, the impacts analysis defaults to the company level because that is the decision-making level. For example, earnings data are held at the company level, not the site level or the company has intentionally established facilities that will not show a profit but exist to serve the larger organization. In either case, EPA does not have sufficient information to evaluate impacts at the site level *as a result of the rule*.

The third condition identifies a site with complete site-level financial information and no confounding factors (i.e., it is not a captive site, a start-up site, or a site with joint or foreign owners) to obscure the financial condition of the site. If the site is unprofitable prior to the regulation, the company may decide to close the site. This is likely to occur before the implementation of the rule to avoid additional investments in

an unprofitable site. The projected closure of a site that is unprofitable prior to a regulatory action should not be attributed to the regulation.

#### ***4.2.3.2 Estimation of Site Closures as a Result of the Rule***

EPA considers the rule to have an impact when a site has a score of 1 or zero in the pre-regulatory condition and a score of 2 or 3 after incurring the costs to respond to the regulation. That is, the site is profitable before the regulation, but not after.

#### ***4.2.3.3 Direct Impacts***

Closure represents a final, irreversible decision in the analysis.<sup>5</sup> EPA estimates direct impacts from site closures as the loss of all employment, production, exports, and revenue associated with the site. This is an upper bound analysis, i.e., illustrating the worst effects because it does not account for other sites increasing production or hiring workers in response to the closure of the first site.<sup>6</sup> The losses are aggregated over all sites to estimate the national direct effect of the regulation.

### **4.3 COMMUNITY AND NATIONAL IMPACTS**

#### **4.3.1 National Direct and Indirect Impacts**

Impacts on the steel industry are known as direct effects, impacts that continue to resonate through the economy are known as indirect effects (effects on input industries), and effects on consumer demand are known as induced effects. The U.S. Department of Commerce, Bureau of Economic Analysis (BEA) tracks these effects both nationally and regionally in massive “input-output” tables, published as the Regional Input-Output Model (RIMS II) multipliers. For every dollar in a “spending” industry, these tables identify the

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<sup>5</sup>Sites that are sold because a new owner presumably can generate a profit when the current owner cannot are considered *transfers*. Transfers are not assumed to incur closure-related impacts.

<sup>6</sup>The market model, however, accounts for this effect.

portion spent in contributing or vendor industries. For this analysis, EPA calculates direct and indirect impacts with the national-level final-demand multipliers for

- # output (2.993 dollars per dollar) and
- # employment (24.131 full-time equivalents per \$1 million in output in 1992 dollars<sup>7</sup>)

for BEA industry 37.0101 blast furnaces and steel mills (DOC, 1996).

#### **4.3.2 Community Impacts**

As mentioned in Section 4.2.2, all employment is considered lost if a site is projected to close. EPA evaluates the community impacts of site closure by examining the increase in 1997 unemployment rate for the county or metropolitan statistical area in which the site is located (Le Vasseur, 1998 and BLS 2000b).

### **4.4 CORPORATE FINANCIAL DISTRESS ANALYSIS**

The closure analysis focuses on the question whether it makes financial sense to upgrade a given site. It does not examine whether the company can raise the capital to make that investment. The corporate financial distress analysis examines whether a company can afford the aggregate costs of upgrading all of its sites.<sup>8</sup> EPA selected a weighted average of financial ratios to examine the impacts of increased pollution control on companies. Many banks use financial ratio analysis to assess the credit worthiness of a potential borrower. If the incurrence of regulatory costs causes a company's financial ratios to move into an unfavorable range, the company will find it more difficult to borrow money. Under these conditions, EPA considers the company to incur financial distress.

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<sup>7</sup>Employment multipliers are based on 1992 data, hence the loss in output needs to be in 1992 dollars.

<sup>8</sup>For a single-site company, the results of the closure analysis take precedence. That is, if the site is determined likely to bear an impact based on the comparison of profitability before and after the regulation, the company is not included in the corporate distress analysis.

Financial ratios are calculated at the business entity or corporate parent level because:

- # Accounting procedures maintain complete financial statements (balance sheet and income statement) at the business entity or corporate level, but not necessarily at the site level. The survey data indicate that many companies do not keep complete financial statements at the site level.
- # Significant financial decisions, such as expansion of a site's capacity, are typically made or approved at the corporate level.
- # The business entity (or corporate parent) is the legal entity responsible for repayment of a loan. The lending institution evaluates the credit worthiness of the business entity, not the site.

The analysis includes both public and private entities. EPA's survey of the industry is the only source of financial data for private companies (U.S. EPA, 1998). Section 4.4.1 describes the Altman Z'-score, a weighted average of financial ratios used to assess financial distress. Section 4.4.2 summarizes the preparation of the survey data for the analysis. Section 4.4.3 reports the preregulatory status of the industry.

#### **4.4.1 Altman Z'-Score**

EPA performed a literature search to review bankruptcy prediction literature from 1990 to 1998 (Kaplan, 1999). Although new approaches have been developed (such as, neural networks, logit models, and multiple discriminant analyses), there is no one method that is clearly superior and no consensus on what is the best approach. EPA determined that—for the purposes of selecting a methodologically sound, reproducible, and defensible—a multiple discriminant analysis of financial ratios was appropriate.

EPA selected a multidiscriminant function (e.g., a weighted-average) of financial ratios, called the Altman Z-score, to characterize the baseline and post-regulation financial conditions of potentially affected firms. The Altman Z-score is a well accepted standard technique of financial analysis with nearly two decades of use (see Brealy and Meyers, 1996, and Brigham and Gapenski, 1997). The Z-score has advantages over consideration of an individual ratio or a collection of individual financial ratios:

- # It is a simultaneous consideration of liquidity, leverage, profitability, and asset management. It addresses the problem of how to interpret the data when some financial ratios look "good" while other ratios look "bad."
- # There are defined threshold or cut-off values for classifying firms in good, indeterminate, and poor financial health. "Rules of thumb" are available for some financial ratios, such as current ratio and times interest earned, but these frequently vary with the industry (U. S. EPA, 1995).

Altman (1993) developed several variations on the multidiscriminant function. EPA selected the  $Z'$ -score because it was developed to evaluate public and private manufacturing firms. The model is:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

where the pre-compliance components are:

$Z'$	=	overall index
$X_1$	=	working capital/total assets
$X_2$	=	retained earnings/total assets
$X_3$	=	earnings before interest and taxes (EBIT)/total assets
$X_4$	=	book value of equity (or net worth)/total debt
$X_5$	=	sales/total assets

The iron and steel survey requested each piece of information for the analysis. (Working capital is equal to current assets less current liabilities). Book value of equity is also called net worth (i.e., total assets minus total debt). Total debt is the sum of current and non-current liabilities.

Taken individually, each of the ratios given above ( $X_1$  through  $X_5$ ) is higher for firms in good financial condition and lower for firms in poor financial condition. Consequently, the greater a firm's distress potential, the lower its discriminant score. An Altman  $Z'$ -score below 1.23 indicates that distress is likely; a score above 2.9 indicates that distress is unlikely.  $Z'$ -scores between 1.23 and 2.9 are indeterminate. In order to focus on marginal firms that are most likely to be affected by the regulation, EPA has chosen to consider an Altman  $Z'$ -score of **1.21** and below to indicate that distress is likely.<sup>9</sup>

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<sup>9</sup>This is consistent with Altman's observation that the average U.S. firm has a lower Z-score today than in the past and he has chosen to adjust cutoff scores or build new models rather than revising the original weightings (Altman, 1993, pp. 179-180).

EPA estimates financial distress based on changes in the Altman  $Z'$ -score as a result of pollution control costs. Capital costs are those developed by the engineering staff for use in the cost annualization model. The annualized pollution control costs for each option were calculated from the engineering estimates of capital and operating and maintenance costs in the cost annualization model (see Appendix A). The estimates of post-compliance scores are calculated as follows:

$$\begin{aligned}
 Z' &= \text{overall index} \\
 X_1 &= \text{working capital}/(\text{total assets} + \text{capital costs}) \\
 X_2 &= \text{retained earnings}/(\text{total assets} + \text{capital costs}) \\
 X_3 &= (\text{EBIT} - \text{pre-tax annualized compliance costs})/(\text{total assets} + \text{capital costs}) \\
 X_4 &= \text{book value of equity (or net worth)}/(\text{total debt} + \text{capital costs}) \\
 X_5 &= \text{sales}/(\text{total assets} + \text{capital costs})^{10}
 \end{aligned}$$

#### **4.4.2 Survey Data Preparation**

##### **4.4.2.1 Baseline Year**

The most recent year for which survey collected data is 1997. This is the baseline year for the economic analysis. The iron and steel industry is cyclical. Therefore the pre-rulemaking condition of the industry varies year-by-year. However, the intent of the economic analysis is to have a “snapshot in time” of the industry and to examine the changes wrought by the imposition of additional pollution control costs, rather than focus on the baseline value itself. The use of 1997 as the baseline year for the analysis does not mean that EPA ignores the events of 1998 and 1999 (see Section 2); its focus, rather, is on the change caused by the incremental costs.<sup>11</sup>

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<sup>10</sup>Although the annualized compliance cost incorporates capital expenditures, one-time non-capital expenditures, and yearly operations and maintenance costs, EPA performed a sensitivity analysis to evaluate whether the one-time costs provided an extra shock to the company. In the sensitivity analysis, the post compliance  $X_3$  parameter is calculated as  $(\text{EBIT} - \text{pre-tax annualized compliance costs} - \text{one-time costs})/(\text{total assets} + \text{capital costs})$ . The change made no difference to the post-regulatory status of any company.

<sup>11</sup>EPA explicitly addresses the 1998 and 1999 industry downturn in the forecasting methods for the site financial analysis, see Section 4.3.

#### ***4.4.2.2 Ownership Changes from 1997***

EPA tracks changes in the industry since the survey. Site ownership changes since 1997 are reflected in the aggregate costs for the new owner. That is, if a business entity had three iron and steel sites in 1997 but purchased two more since (and these sites were surveyed), the aggregate costs for the business entity reflects all five sites.

#### ***4.4.2.3 Determination of Which Level in the Corporate Hierarchy for Data to Use in Analysis***

Corporate ownership in the iron and steel industry is frequently complex, reflecting mergers and acquisitions that occurred over the years. EPA examined the survey data site-by-site to ensure that all sites that could ultimately be tied to the same corporate parent were analyzed with the same data whether it might have been entered as the business entity or the corporate parent. For all joint entities, the corporate financial analysis was performed with Section 2 (site/joint entity) data rather than any of the owning entities. Section 3 data were used if they represented aggregate U.S. holdings of a foreign business entity. EPA did not use financial information for foreign firms due to differences in generally accepted accounting principals among countries.

#### ***4.4.2.4 Aggregation Of Site-level Regulatory Cost Data***

EPA estimated costs on a site basis. EPA then aggregated site-level regulatory costs to the business entity level in order to assess the impact of the total costs incurred by the business entity.

#### **4.4.3 Evaluation of Pre-regulatory Altman Z' Scores**

EPA calculated the pre-regulatory condition of the industry in order to evaluate the post-regulatory impacts on an incremental basis. Of the 115 companies in the initial Altman Z' analysis:

- # 27 fall into the “distress likely” zone
- # 56 are in the indeterminant zone

# 32 are in the “distress unlikely” zone.

Of the 27 companies in the “financial distress likely” zone,

# 2 took Chapter 11 since 1997 (i.e., declared bankruptcy).

# 4 changed ownership.

# 5 had just begun operations in 1997. These show all the startup costs, little revenues, and no retained earnings.

# 6 are non-startup joint entities. The Altman  $Z'$  calculation is based on the joint entity's financial statements rather than those of any of the businesses that share ownership of the site.

# 11 are owned by a foreign company. Because generally accepted accounting principles (GAAP) differ from country to country, the Altman  $Z'$  was calculated on the site financial data rather than the owning company. It appears that some distortion may still be present in the data.

Some companies may fall into two or more categories. The financial statements of other companies in the zone frequently indicate various stages of financial distress such as shareholder deficits, inability to pay dividends, certain (unspecified) operating problems, and not being compliant with debt covenants. In other words, for a multitude of reasons, the Altman  $Z'$ -score identifies a reasonable set of companies that might be considered distressed.

#### **4.4.4 Implications of a $Z'$ -score Below The Cut-off**

What does it mean for a company to have its  $Z'$ -score fall below the cut-off for “distress likely”? It should be noted that Altman used the phrase “bankruptcy likely” rather than “distress.” First, this does not mean that a company will immediately declare bankruptcy once its score falls into that danger zone. It is a warning flag. A company has the opportunity to change its behavior during this warning period to avoid the projected bankruptcy. The Chrysler Corporation is an example; Altman, 1993 cites other examples.

Second, taking Chapter 11 (bankruptcy) is not the same as taking Chapter 7 (liquidation). A company that takes Chapter 11 is protected from its creditors for a period of time while it reorganizes itself. A company can continue to operate while it is in Chapter 11. Geneva Steel filed for Chapter 11 on February

1, 1999 but continued to operate through the next year (Geneva Steel, 2000). Shenango Coke went into Chapter 11 in 1992. A company has the chance to emerge from Chapter 11. In contrast, a firm is liquidated when there is no hope for rehabilitation. Altman notes, "Economically, liquidation is justified when the value of the assets sold individually exceeds the capitalized value of the assets in the marketplace." (Altman, 1993, p. 33).

Third, other forms of response are possible and seen in the initial evaluation of the steel industry. Shedding non-productive assets, merging with another company, or being purchased by another company are all possible responses to financial distress.

What this means for the economic analysis is that:

- # a company that moves into the distress likely category as a result of added pollution control costs is considered to be distressed as a result of the regulation. It does not mean that EPA expects the company to liquidate immediately upon promulgation. The company, however, will have to change the way it operates to respond to the regulation and remain out of bankruptcy.
- # a company in the distress likely category before the rulemaking cannot be evaluated for a change in status. It does not mean that EPA expects the company to liquidate in the very near future.

## **4.5 MARKET MODEL**

With the market model, the analysis moves to the larger-scale industry-wide impacts. When EPA evaluates site closure impacts as the loss of all production at the site, this is a possible overestimate because other sites could step up their production in response. The output from the market model, however, incorporates such effects. In contrast, while the market model developed for the steel industry may estimate the reduction in production due to higher costs, it does not specify at which sites the reductions might occur. So the results from the various models are related but not necessarily identical.

A market model is a set of equations designed to represent the behavior between steel producers and steel consumers. Increased pollution control generally adds to the cost of production.<sup>12</sup> Steel producers then ask for a higher price to cover their higher costs. Steel consumers may respond to higher prices by buying less domestic steel and/or increasing imports. If consumers buy less steel, then producers may cut back production, thereby leading to job losses. A purpose of a market model is to estimate the supply and demand for steel in order to quantify these regulatory impacts.

EPA's approach to modeling the steel industry is to specify a cost function that can be estimated econometrically and derive the market supply relationship from the cost function (Applebaum, 1982; Considine, 1991; Kwack, 1991). EPA specified the cost function with the following characteristics:

- # translog function
- # one good
- # two production factors (capital and materials)
- # subject to technological change (continuous casting)

The steel market supply relationship is derived from the translog cost function and equilibrium conditions for profit maximization. In general, a firm maximizes profits when the cost to produce an additional unit (i.e., marginal cost) equals the revenue earned from selling that unit (i.e., marginal revenue). Marginal cost is derived by differentiating the cost function with respect to output. The marginal revenue, however, will vary with the competitiveness of the market in which the firm sells. The formula expressing marginal cost incorporates a parameter that measures the degree of market competitiveness.

The U. S. demand for steel is modeled as the sum of U.S. demand for domestic steel plus imports (i.e., U.S. demand for imported steel). It is calculated as a function of the prices of domestic steel, imported steel, and steel substitutes and measures of activity in major steel-using industries. Conversely, the total demand for U.S. steel is modeled as the sum of U.S. demand for domestic steel plus exports (i.e., foreign demand for U.S. steel). For the purpose of this study, EPA aggregated all other countries into a single entity that trades steel with the U.S. EPA used the relations between key elasticities in the Armington specification

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<sup>12</sup>Although not always, see Table 5-4. The regulatory options for stainless steel finishing operations that include acid recovery lead to annual savings in material costs.

trade model (Armington, 1969a; Armington, 1969b) to estimate the elasticity of demand for imported steel with respect to a change in the price of U.S. steel and the elasticity of demand from the rest of the world for U.S. steel with respect a change in the price of U.S. steel.

The steel market model consists of five equations:

- # a translog cost function
- # two conditional factor demand functions (capital and materials) derived from the cost function,
- # a supply relationship, and
- # a domestic demand function.

EPA estimated all equations using nonlinear three-stage least-squares (NL3SLS). NL3SLS is a “full information” econometric technique; all equations are estimated simultaneously, which allows the cross-equation restrictions (e.g., between the cost function and the conditional factor demand equations) to improve estimates of the parameters.<sup>13</sup> EPA used 20 years of Census and industry data from 1977 to 1997 as its sample time frame. The model estimates the supply shift, and the resulting changes in: domestic price, domestic consumption, export demand, and import supply. A detailed discussion of the theoretical foundation for the model, data sources, and indices is located in the rulemaking record.

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<sup>13</sup>A “limited information” technique such as two stage least squares estimates each equation separately; the “information” in the conditional factor demand equations, for example, has no effect on the parameter estimates for the cost function.

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## CHAPTER 5

### REGULATORY OPTIONS: DESCRIPTIONS, COSTS, AND CONVENTIONAL POLLUTANT REMOVALS

EPA is proposing new effluent limitation and pretreatment standards for the iron and steel industry. EPA proposes a two-tier classification for the industry—subcategories and segments, see Table 5-1. There are seven subcategories and five of them have multiple segments. The segments for three subcategories—integrated hot forming operations/stand-alone hot forming mills (Subcategory D), non-integrated steelmaking and hot forming operations (Subcategory E), and steel finishing operations (Subcategory F)—are based on steel type. Stainless steel forms one segment while carbon and alloy steels for the other segment. For simplicity, the term “carbon” refers to both carbon and alloy steels throughout the rest of this chapter.

Section 5.1 describes the technological bases for the proposed standards. Section 5.2 identifies the cost associated with each option while Section 5.3 summarizes associated conventional pollutant removals and cost per pound removed. A site may have operations in more than one subcategory; combined costs are discussed in Section 5.4 below. All costs discussed in this chapter are in 1997 dollars. Cost-effectiveness results are presented in Appendix C.

#### 5.1 DESCRIPTION

Table 5-2 presents the regulatory options for each of the seven subcategories: Cokemaking, Ironmaking, Integrated Steelmaking, Integrated and Stand-Alone Hot-Forming, Non-Integrated Steelmaking and Hot-Forming, Steel Finishing, and Other Operations. The final column describes the treatment components for each option. More information on the regulatory options is located in the Development Document (EPA, 2000).

The **cokemaking** subcategory has two segments—one where the cokemaking by-products are recovered and the second where they are not. The cokemaking subcategory does not have subsegments. EPA considered four regulatory options each for direct and indirect dischargers. BAT 1 includes tar

**Table 5-1**

**Proposed Iron and Steel Manufacturing Subcategories and Segments**

<b>Subcategory</b>		<b>Segment</b>
A.	Coke Making	By-product
		Other—Nonrecovery
B.	Ironmaking	Blast furnace
		Sintering
C.	Integrated Steelmaking Operations	
D.	Non-Integrated Steelmaking and Hot Forming Operations	Carbon & Alloy Steel
		Stainless Steel
E.	Integrated Hot Forming Operations, Stand-Alone Hot Forming Mills	Carbon & Alloy Steel
		Stainless Steel
F.	Steel Finishing Operations	Carbon & Alloy Steel
		Specialty Steel
G.	Other Operations	Direct Iron Reduction
		Briquetting (HBI)
		Forging

**Table 5-2**

**Description of Regulatory Options by Subcategory**

<b>Subcategory</b>	<b>Discharge Status</b>	<b>Regulatory Option</b>	<b>Description of Regulatory Option</b>
Cokemaking	Direct	BAT 1	# Tar Removal, ammonia stripping, and biological treatment with clarification
			# Liquid/solid separation and temperature control processes, where applicable
		BAT 2	# BAT 1 + cyanide and metals treatment with sludge dewatering
		BAT 3	# BAT 1 + two-stage alkaline chlorination
	Indirect	BAT 4	# BAT 3 + granular activated carbon and filtration
		PSES 1	# Tar removal, equalization, and ammonia stripping
		PSES 2	# PSES 1 + cyanide precipitation and mixed media filtration
		PSES 3	# PSES 1 + biological treatment with clarification
Ironmaking	Direct	PSES 4	# PSES 3 + two-stage alkaline chlorination
			# Solids removal, cooling tower, and high rate recycle
			# Metals precipitation, alkaline chlorination, and filtration for blowdown wastewater
		BAT 1	# Solids removal, cooling tower, and high rate recycle
	Indirect		# Solids removal, cooling tower, and high rate recycle
		PSES 1	# Metals precipitation and filtration for blowdown wastewater

<b>Subcategory</b>	<b>Discharge Status</b>	<b>Regulatory Option</b>	<b>Description of Regulatory Option</b>
Integrated Steelmaking	Direct	BAT 1	# Solids removal and high rate recycle
			# Cooling towers are necessary if a site employs vacuum degassing or continuous casting
			# Metals precipitation for blowdown wastewater
Integrated and Stand-Alone Hot-Forming (Carbon and Stainless Steel)	Indirect	PSES 1	# Same as BAT 1
			# Scale pit with oil skimming, roughing clarifier, filtration, cooling tower, and high rate recycle
			# Same as BAT 1
Non-Integrated Steelmaking and Hot-Forming	Direct	BAT 1 (Carbon)	# Scale pit with oil skimming, filtration, cooling tower, and high rate recycle
		BAT 1 (Stainless)	# Scale pit with oil skimming, filtration, cooling tower, and high rate recycle
		BAT 2 (Stainless)	# BAT 1 + metals precipitation and filtration for blowdown wastewater
	Indirect	PSES 1 (Carbon)	# Same as BAT 1
		PSES 1 (Stainless)	# Same as BAT 1

<b>Subcategory</b>	<b>Discharge Status</b>	<b>Regulatory Option</b>	<b>Description of Regulatory Option</b>
Steel Finishing	Direct	BAT 1 (Carbon)	# Diversion tank, oil removal, hexavalent chrome reduction, equalization, metals precipitation, and sedimentation and sludge dewatering
		BAT 1 (Stainless)	# Diversion tank, oil removal, hexavalent chrome reduction, equalization, metals precipitation, sedimentation and sludge dewatering, and acid purification
	Indirect	PSES 1 (Carbon)	# Same as BAT 1
		PSES 1 (Stainless)	# Same as BAT 1
Other Operations	Direct	BAT 1 (DRI)	# Solids removal, clarifier, cooling tower, and high rate recycle
		BAT 1 (Forging)	# Filtration for blowdown wastewater
		BAT 1	# Oil/water separator
	Indirect	PSES 1 (DRI)	# Same as BAT 1
		PSES 1 (Forging)	# Same as BAT 1

removal, ammonia stripping, biological treatment, liquid and solid separation, and temperature control processes. BAT 2 adds cyanide and metals treatment to BAT 1, while BAT 3 adds two-stage alkaline chlorination to BAT 1. Finally, BAT 4 adds filtration and granular activated carbon to BAT 3. PSES 1 utilizes tar removal, equalization, and ammonia stripping. PSES 2 adds cyanide treatment to PSES 1. PSES 3 adds biological treatment to PSES 1; that is, it is comparable to BAT 1. PSES 4 adds alkaline chlorination to PSES 3; that is, it is comparable to BAT 3.

EPA considered one regulatory option each for direct and indirect dischargers in the **ironmaking** subcategory. The treatment unit is the components listed in the first bullet while the second bullet describes the blowdown treatment.

EPA considered one regulatory option for direct dischargers and indirect dischargers in the **integrated steelmaking** subcategory. Cooling towers are necessary only if a site employs vacuum degassing or continuous casting.

**Hot forming** operations are found at both integrated sites and stand-alone sites. The only regulatory option for all four types of sites (carbon/direct discharger, carbon/indirect discharger, stainless/direct discharger, stainless/indirect discharger) includes a scale pit with oil removal, a roughing clarifier with oil removal, media filtration, cooling, and high rate recycle.

**Non-integrated steelmaking** uses an electric arc furnace (EAF) rather than a basic oxygen furnace. The technologies do not vary by whether the sites process carbon steel or stainless steels, but the costs and pollutant removals do vary. The BAT 2 option, for stainless steel only, adds metals precipitation and filtration to the treatment train.

Both carbon and stainless steel options in the **finishing** subcategory include a diversion tank, oil removal, hexavalent chrome reduction, equalization, metals precipitation, and sedimentation and sludge dewatering. The stainless steel segment has an added step of acid purification.

The **other** operations subcategory, is further subdivided into DRI operations and forging operations. (All briquetting operations are zero discharge.) For DRI operations, BAT 1 and PSES 1 require solids removal, a clarifier, a cooling tower, high rate recycle, and blowdown treatment. An oil-water separator is required for both direct and indirect dischargers with forging operations.

## 5.2 SUBCATEGORY COSTS

Table 5-3 summarizes the capital, annual operating and maintenance (O&M), and one-time non-equipment costs for each of the regulatory options considered<sup>1</sup>. **Cokemaking** costs are presented in Table 5-3 for both direct and indirect dischargers. For direct dischargers, the capital costs range from \$8.0 million to \$54.0 million while the post-tax annualized costs range from \$1.0 million to \$11.7 million. For indirect dischargers, the capital costs range from none to \$32.1 million while the post-tax annualized costs range from \$0.24 million to \$6.4 million.

**Ironmaking** costs for direct and indirect dischargers are \$25.8 million in capital costs while the post-tax annualized cost is \$4.3 million. **Integrated steelmaking** costs for direct and indirect dischargers are \$16.8 million in capital costs while the post-tax annualized cost is \$3.5 million. For these subcategories, costs are presented on a combined basis because there are three or fewer indirect dischargers in each subcategory.

**Integrated and stand-alone hot forming** costs differ according to whether the site processes carbon or stainless steel. The capital costs are \$111.8 million for direct discharging carbon steel sites; there are no costs associated with direct discharging stainless steel sites. The post-tax annualized costs are \$20.4 million for carbon steel sites. For indirect dischargers, the capital costs are \$0.31 million for carbon steel sites and \$0.76 million for stainless steel sites. The post-tax annualized costs are \$0.08 million for carbon steel sites and \$0.14 million for stainless steel sites.

**Non-integrated steelmaking and hot forming** costs also differ by whether the site processes carbon or stainless steel. For carbon steel processors who are direct dischargers, the capital costs for BAT Option 1 are \$18.3 million. The post-tax annualized costs for Option 1 are \$2.7 million. There are two options for sites with stainless steel operations and direct discharges—the BAT capital cost for Option 1 is \$0.41 million and \$3.7 million for Option 2 while the post-tax annualized cost is \$0.07 for Option 1 and \$0.66 for Option 2. For indirect dischargers, the capital costs for Option 1 are \$2.5 million for carbon steel sites; there are no capital costs associated with stainless steel sites. The post-tax annualized costs for Option 1 are \$0.43 million for carbon steel sites and \$0.02 million for stainless steel sites.

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<sup>1</sup>Consultant mill services to conduct an evaluation of the water management practices and operations is an example of a one-time non-equipment cost.

**Table 5-3**  
**Regulatory Options Costs by Subcategory**  
**(in Millions of \$1997)**

Subcategory	Segment	Regulatory Option	Capital Costs	O&M Costs	One-Time Non-Equipment Costs	Post-Tax Annualized Costs	Pre-Tax Annualized Costs
Cokemaking		BAT 1	\$8.0	\$0.13	\$0.30	\$1.0	\$.93
		BAT 2	\$12.4	\$3.0	\$0.30	\$3.9	\$4.2
		BAT 3	\$34.4	\$5.3	\$0.30	\$6.9	\$8.6
		BAT 4	\$54.0	\$10.1	\$0.30	\$11.7	\$15.2
		PSES 1	\$0	\$0.29	\$0.15	\$0.24	\$0.29
		PSES 2	\$6.0	\$1.8	\$0.15	\$1.7	\$2.2
		PSES 3	\$18.6	\$3.3	\$0.20	\$3.9	\$5.0
		PSES 4	\$32.1	\$5.8	\$0.20	\$6.4	\$8.5
Ironmaking		BAT 1 and PSES 1	\$25.8	\$2.7	\$0.55	\$4.3	\$5.4
Integrated Steelmaking		BAT 1 and PSES 1	\$16.8	\$2.9	\$1.9	\$3.5	\$4.8
Integrated and Stand-Alone Hot-Forming	Carbon	BAT 1	\$111.8	\$15.6	\$0.97	\$20.4	\$27.5
		PSES 1	\$0.31	\$0.05	\$0.13	\$0.08	\$0.08
	Stainless	PSES 1	\$0.76	\$0.16	\$0.08	\$0.14	\$0.23
Non-Integrated Steelmaking and Hot-Forming	Carbon	BAT 1	\$18.3	\$1.9	\$3.7	\$2.7	\$4.0
	Stainless	BAT 1	\$0.41	\$0.06	\$0.21	\$0.07	\$0.11
		BAT 2	\$3.7	\$0.59	\$0.21	\$0.66	\$0.87
	Carbon	PSES 1	\$2.5	\$0.35	\$0.84	\$0.43	\$0.64
	Stainless	PSES 1	\$0	\$0	\$0.38	\$0.02	\$0.03
Steel Finishing	Carbon	BAT 1	\$14.2	\$1.9	\$1.6	\$2.8	\$3.4
	Stainless	BAT 1	\$15.2	(\$1.2)	\$0.69	\$0.24	\$0.20
	Carbon	PSES 1	\$6.0	\$1.2	\$0.83	\$1.6	\$1.8
	Stainless	PSES 1	\$4.0	\$0.24	\$0.39	\$0.36	\$0.56

**Steel finishing** is the third subcategory where costs differ according to the type of steel processed. For both direct and indirect stainless steel processors, acid purification allows a site to reuse acid. This reduces acid purchase and disposal costs for an overall savings in annual O&M (see negative entry). For direct dischargers, the capital costs are \$14.2 million for carbon steel sites and \$15.2 million for stainless steel sites. The post-tax annualized costs are \$2.8 million for carbon steel sites and \$0.24 million for stainless steel sites. For indirect dischargers, the capital costs are \$6.0 million for carbon steel sites and \$4.0 million for stainless steel sites. The post-tax annualized costs are \$1.6 million for carbon steel sites and \$0.36 million for stainless steel sites.

The **other** subcategory consists of DRI, forging, and briquetting operations. No costs are shown for two reasons. First, none of the sites with briquetting operations discharge process wastewater. Second, for DRI and forging, the costs for wastewater pollution control are BPT costs. Costs are presented on a combined basis due to the small number of sites with these operations. No capital costs are involved; post-tax annualized costs are \$0.05 million.

### 5.3 COST REASONABLENESS

EPA is evaluating technology options for the DRI and forging segments of the Other Operations Subcategory for the control of only conventional parameters at BPT. CWA Section 304(b)(1)(B) requires a cost-reasonableness assessment for BPT limitations. In determining BPT limitations, EPA must consider the total cost of treatment technologies in relation to the effluent reduction benefits achieved by such technology. This inquiry does not limit EPA's broad discretion to adopt BPT limitations that are achievable with available technology unless the required additional reductions are wholly out of proportion to the costs of achieving such marginal reduction.

The cost-reasonableness ratio is average cost per pound of pollutant removed by a BPT regulatory option. The cost component is measured as pre-tax total annualized costs. In this case, the pollutants removed are conventional pollutants although in some cases, removals may include priority and nonconventional pollutants. For the DRI segment, the evaluated BPT option 1 removes

approximately 800 pounds of conventional pollutants with a cost-reasonableness ratio of \$6, see Table 5-4. For the forging segment, the evaluated BPT option 1 removes approximately 500 pounds of conventional pollutants with a cost-reasonableness ratio of \$15. EPA considers the cost-reasonableness ratio to be acceptable and the proposed option to be cost-reasonable in both segments.

## **5.4 COST COMBINATIONS**

EPA proposes to divide the iron and steel industry into seven subcategories. These, in turn, are further segregated into segment and discharge status (direct or indirect). The cokemaking subcategory has four BAT regulatory options and four PSES regulatory options. Direct dischargers in the non-integrated subcategory with stainless operations have two options. All other subcategory/segment/ discharge combinations have one BAT or PSES regulatory option. This implies that there are  $4 \times 4 \times 2 = 32$  possible cost combinations; 64 possibilities if a “no action” option is considered. EPA examined many of these combinations and the information is located in the rulemaking record.

EPA is co-proposing two cost combinations, see Table 5-5. Cost Combinations A and B are the same for all categories except indirect dischargers in the cokemaking subcategory. Cost Combination A includes Option 1 and Cost Combination B includes Option 3 for indirect dischargers in the cokemaking subcategory. Table 5-6 summarizes the industry costs for the co-proposed cost combinations. The capital costs for Cost Combination A are \$237.0 million while capital costs for Cost Combination B are \$255.5 million. The pre-tax annualized cost for Cost Combination A is \$54.3 million and \$59.0 million for Cost Combination B. Note that the pre-tax annualized costs for each of these cost combinations are well below the \$100 million criterion for considering the iron and steel effluent guideline a major rule under Executive Order 12866.

## **5.5 REFERENCES**

U.S. EPA. 2000. U.S. Environmental Protection Agency. Development document for the proposed effluent limitations guidelines and standards for the iron and steel manufacturing point source category. Washington, DC. EPA 821-B-00-011.

**Table 5-4**

**Cost-reasonableness Ratio**

<b>Subcategory</b>	<b>Segment</b>	<b>Selected Option</b>	<b>Removal of Conventional Pollutants (lbs.)</b>	<b>Pre-tax Annualized Cost (Millions)</b>	<b>Cost Per Pound of Conventional Pollutant Removed</b>
Other	DRI	1	747	\$0.005	\$6
Other	Forging	1	444	\$0.01	\$14

**Table 5-5**

**Summary of Cost Combinations**

Subcategory	Segment	Discharge Status	Co-Proposal Options	
			A	B
Cokemaking		BAT	3	3
		PSES	1	3
Ironmaking		BAT	1	1
		PSES	1	1
Integrated Steelmaking		BAT	1	1
		PSES	No Regulation	No Regulation
Integrated Steelmaking and Hot-Forming	Carbon	BAT	1	1
		PSES	No Regulation	No Regulation
	Stainless	BAT	No Regulation	No Regulation
		PSES	No Regulation	No Regulation
Non-Integrated	Carbon	BAT	1	1
		PSES	No Regulation	No Regulation
	Stainless	BAT	1	1
		PSES	1	1
Steel Finishing	Carbon	BAT	1	1
		PSES	No Regulation	No Regulation
	Stainless	BAT	1	1
		PSES	No Regulation	No Regulation
Other Operations	DRI	BPT	1	1
		PSES	No Regulation	No Regulation
	Forging	BPT	1	1
		PSES	No Regulation	No Regulation

**Table 5-6**

**Industry Costs  
(in Millions \$1997)**

	<b>Cost Combinations</b>	
	<b>A</b>	<b>B</b>
Capital Costs	\$237.0	\$255.5
Operating and Maintenance Costs	\$29.4	\$32.4
One-Time Non-Equipment Costs	\$10.6	\$10.6
Post-Tax Annualized Costs	\$41.2	\$44.8
Pre-Tax Annualized Costs	\$54.3	\$59.0

## **CHAPTER 6**

### **ECONOMIC IMPACT RESULTS**

Chapter 6 describes the economic effects resulting from the costs for complying with the proposed iron and steel industry rule. The impacts are estimated with the models discussed in Chapter 4 and the costs presented in Chapter 5. Section 6.1 reports the estimated impacts from the proposed BAT and PSES costs for existing sources. The impacts are examined from the smallest scale (site closure by subcategory costs) to industry-wide impacts (market and trade effects). EPA reports its findings for NSPS and PSNS for new sources in Section 6.2

#### **6.1 BEST AVAILABLE TECHNOLOGY/PRETREATMENT STANDARDS FOR EXISTING SOURCES (BAT AND PSES)**

##### **6.1.1 Subcategory Costs**

EPA examined whether the cost of upgrading pollution control in any subcategory was sufficient to result in site closure<sup>1</sup>. For Cokemaking BAT Option 3 and BAT Option 4, the costs lead to one projected site closure. No closures are projected for any other option in any other subcategory.

The projected closure is associated with # 500 employees. The closure would result in an increase in the regional unemployment rate from 9.9 to 10.5 percent (i.e., an increase of 0.6 percentage points). For reasons of confidentiality, revenue, shipment, and export data are not disclosed.

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<sup>1</sup>The site closure methodology is presented in Section 4.2. For a site to be considered closed rather than upgraded as a result of the regulation, its projected present value of future cash flow is neutral or positive prior to regulatory costs and negative after inclusion of regulatory costs. Section 4.2.1.1 explains why EPA did not include an estimate of salvage value in the calculation.

### **6.1.2 Aggregated Subcategory Costs and Projected Site Closures**

A site may have multiple operations—e.g., cokemaking, ironmaking, steelmaking, hot-forming, and finishing—with regulatory costs associated with each option. The aggregated subcategory costs do not result in any additional site closures. The only closure reported in this analysis is the same site closure that occurred with only the subcategory costs (see Section 6.1.1).

The aggregated costs used in the site-level analysis are the two co-proposed cost combinations described Section 5.4. Cost combination A has cokemaking PSES set to Option 1 while Cost Combination B has cokemaking PSES set to Option 3. Because both cost combinations contain cokemaking BAT Option 3, EPA projects the same site closure and direct impacts discussed in Section 6.1.1. However, no additional sites close when the costs for all operations at the location are aggregated.

### **6.1.3 Corporate Financial Distress**

The level above the site is the company that owns one or more iron and steel sites. The corporate financial distress analysis identifies situations where it might make financial sense to upgrade each individual site but the company cannot bear the combined costs of upgrading all of its sites.

One or more large companies move into the distressed category as a result of the added pollution control with both cost combinations A and B. These companies report a total employment in excess of 14,000 people. The analysis incorporates both public and private entities; hence the analysis is based on 1997, the most recent supplied in the EPA survey.

EPA identified the hot-forming subcategory as having the highest capital costs of any proposed regulatory option. In analyzing various cost combinations, EPA determined that, if hot-forming BAT is not proposed, the companies would not move into financial distress. EPA then explored a 5-year delayed implementation for the hot-forming subcategory. The delay would apply to all sites in the subcategory and therefore to the firms that own them. The delay results in lower costs in 1997 dollars because of the time value of money. The discount factor that reflects the reduction in cost is calculated as  $1/(1 + K)^n$  where K is the discount rate (or what the company pays to raise capital for investments) and n is the number of years

for the delayed implementation. For example, if a company has a discount rate of 9.72 percent and the implementation is delayed for 5 years, the discount factor is  $1/(1.0972)^5$  or 0.629. That is, the time value of money would reduce the effective cost to the company by about 37 percent. Although the delay improved the financial condition of the one or more companies in the post-regulatory period, it was not sufficient to bring the Z'-score(s) to 1.21 or greater. EPA is not proposing a 5-year delayed implementation for the hot-forming subcategory.

As mentioned in Section 4.4, taking Chapter 11 (bankruptcy) is not the same as taking Chapter 7 (liquidation). EPA does not expect a company projected to move into financial distress to liquidate immediately upon promulgation. The company, however, will have to change the way it operates to respond to the regulation and remain out of bankruptcy. An analogy might be that the proposed costs move a sickly patient into intensive care. The patient may or may not return to health but much effort will be spent in the attempt. The site analysis indicates that all but one facility are projected to remain viable and open, thus the distressed firm may sell assets rather than liquidate.

#### **6.1.4 Market and Trade Impacts**

Table 6-1 summarizes the market impacts for the co-proposed Cost Combinations A and B. The pre-tax annualized cost of each combination is listed in the first row (see also Table 5-6). The difference in pre-tax annualized costs between the two co-proposed cost combinations is \$4.7 million. Each of the market impacts presented in Table 6-1 are the same with the exception of domestic production and export demand. Export demand differs by .02% among the co-proposed cost combinations. For each of the other parameters, the co-proposed cost combinations are the same or vary by only .01%. Under both options, imports increase by one-tenth of one percent (approximately \$7.8 million), domestic prices increase by less than one-tenth of one percent, and exports fall by less than three-tenths of one percent (approximately \$9.5 million). For reference, 1997 imports are estimated to have totaled \$6.5 billion in value while exports are estimated to have totaled approximately \$3.8 billion.

Pursuant to Executive Order 12898, EPA examined the effects of increased prices on low-income consumers. EPA calculated the percentage of average expenditures per consumer unit spent on steel products by income group using the Consumer Expenditure Survey. No category for steel products exists

**Table 6-1****Market Impacts**

<b>Parameter</b>	<b>Cost Combinations</b>	
	<b>A</b>	<b>B</b>
Pre-tax Annualized Cost (Millions, \$1997)	\$54.3	\$59.0
Supply Shift (annualized cost as a percentage of baseline price)	0.10%	0.11%
Domestic Price	0.08%	0.08%
Domestic Consumption	-0.11%	-0.12%
Domestic Production	-0.15%	-0.16%
Import Supply	0.11%	0.12%
Export Demand	-0.23%	-0.25%

in the survey, instead EPA determined which products were potentially constructed of steel. The items include the following: processed fruits, processed vegetables, miscellaneous foods, major appliances, small appliances, and vehicles, see Table 6-2.

There are no significant differences among the percentage of average expenditures for all income groups with the exception of the lowest income group—under \$5,000. According to the Consumer Expenditure Survey, this income group spends almost 69 percent of its income on vehicle purchases. This income group, then, may be adversely affected by the rule because the automobile manufacturers may pass on the higher steel cost to the consumers. All cost combinations examined by EPA lead to less than one-tenth of one percent price increase (see Table 6-1), EPA does not consider minority and low-income populations to be disproportionately affected.

#### **6.1.5 Direct and Community Impacts**

EPA evaluates community impacts by examining the potential increase in county or metropolitan statistical area (MSA) unemployment. EPA assumes all employees of the affected facilities reside in the county (if the county is not part of a larger metropolitan area) or the metropolitan area in which the facilities are located.

In the case of the single facility closure associated with cokemaking BAT options 3 and 4, the county unemployment rate increases by 0.6 percentage points. Pursuant to Executive Order 12898, EPA examined whether the closure represented a disproportionately high and adverse impact on minority and low-income populations. The projected site closure is located in a county with a lower than state average minority population and higher than state average poverty rate and unemployment rate.

In the case of the BAT option for the carbon and alloy steel alloy segment of the integrated and stand-alone hot-forming subcategory, EPA examined the effects if the one or more firms that become financially distressed lay off all of its workers, i.e., a worst-case scenario. In this case, the increase in unemployment rate ranges from less than 0.1 to 2.1 percentage points, depending on the prevailing unemployment rate and the sizes of the affected facility and community.

Table 6-2

## Reported Typical Expenditures by Income-Level for Steel-Containing Products

Item	Total	Less than \$5,000	\$5,000 to \$9,999	\$10,000 to \$14,999	\$15,000 to \$19,999	\$20,000 to \$29,999	\$30,000 to \$39,999	\$40,000 to \$49,999	\$50,000 to \$69,999	\$70,000 and over
Number of Consumer units	84,115	4,259	8,143	8,469	7,352	12,621	10,123	7,654	11,300	14,193
Average Income Before Taxes	\$41,622	\$1,888	\$7,735	\$12,375	\$17,464	\$24,648	\$34,473	\$44,289	\$58,516	\$108,257
Average Income After Taxes	\$38,358	\$1,738	\$7,636	\$12,155	\$16,951	\$23,596	\$32,393	\$40,890	\$53,802	\$97,419
Average Expenditures Per Consumer Unit										
<b>Total Average Expenditures:</b>	\$37,260	\$17,502	\$14,838	\$19,958	\$22,810	\$27,941	\$33,616	\$39,934	\$49,376	\$73,786
Processed Fruits:	\$104	\$63	\$59	\$70	\$81	\$88	\$100	\$120	\$123	\$169
% of Income (after)	0.27%	3.62%	0.77%	0.58%	0.48%	0.37%	0.31%	0.29%	0.23%	0.17%
Processed Vegetables:	\$78	\$36	\$49	\$55	\$64	\$78	\$78	\$80	\$101	\$109
% of Income (after)	0.20%	2.07%	0.64%	0.45%	0.38%	0.33%	0.24%	0.20%	0.19%	0.11%
Miscellaneous Foods:	\$408	\$237	\$235	\$261	\$280	\$344	\$413	\$473	\$535	\$627
% of Income (after)	1.06%	13.64%	3.08%	2.15%	1.65%	1.46%	1.27%	1.16%	0.99%	0.64%
Major Appliances:	\$172	\$89	\$72	\$146	\$121	\$136	\$195	\$144	\$246	\$268
% of Income (after)	0.45%	5.12%	0.94%	1.20%	0.71%	0.58%	0.60%	0.35%	0.46%	0.28%
Small Appliances:	\$87	\$29	\$35	\$37	\$45	\$68	\$75	\$91	\$139	\$171
% of Income (after)	0.23%	1.67%	0.46%	0.30%	0.27%	0.29%	0.23%	0.22%	0.26%	0.18%
Vehicle Purchase:	\$3,043	\$1,193	\$829	\$1,724	\$1,876	\$2,411	\$2,588	\$3,274	\$4,664	\$5,732
% of Income (after)	7.93%	68.64%	10.86%	14.18%	11.07%	10.22%	7.99%	8.01%	8.67%	5.88%

Source: U.S. Census, Bureau of Labor Statistics, Consumer Expenditure Survey, 1998

### **6.1.6 National Direct and Indirect Impacts**

If a site is projected to close, there are direct effects such as the loss in employment and output at the closed facility. The impacts resonate through the economy. EPA used the Department of Commerce's national final demand multipliers from the Regional Input-Output Modeling System to estimate these effects (see Section 4.3). For subcategory costs, Cokemaking BAT 3 and BAT 4 each result in one closure. Both options lead to an estimated loss in employment of less than 500 employees and a reduction in national output of approximately \$60 million.

Because Altman's Z-score is a measure of financial distress and not Chapter 7 liquidation, EPA considered it imprudent to calculate a worst case estimate of the national direct and indirect impacts on employment and output based on the output of the company that moves into financial distress with the proposed cost combinations. The facility-level analysis indicates that virtually all facilities are going concerns. In light of the facility analyses, EPA expects that a financially distressed firm would respond to the distress by selling assets. The sale of assets (such as a facility) may include continuing operation by the purchasing firm, resulting in limited job losses or secondary impacts.

### **6.1.7 Summary of Impacts on Existing Sources**

Table 6-3 summarizes the economic impacts of the proposed regulation on existing sources. Note that the aggregate subcategory costs do not close any additional sites beyond the one projected to close due to subcategory costs alone<sup>2</sup>. EPA interprets the results of the subcategory and site analyses to indicate the viability of virtually all facilities as going concerns. One or more companies with a total of at least 14,000 employees experience financial distress predominantly because of the high capital costs associated with the hotforming pollution control option. The worst case assumption is that all the facilities would close. Under this assumption, regional unemployment increases by 0.1 percent to 2.1 percent. Given the viability of the individual sites, however, EPA expects that the company would respond to distress by selling assets. The sale of assets (such as a facility) may include the continued operation by the purchasing firm, resulting in limited job losses or secondary impacts.

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<sup>2</sup>EPA ran the closure model with and without the "cost pass-through" factor estimated by the market model. The results were the same for both sets of runs.

**Table 6-3**

**Economic Impacts of the Proposed Regulation on Existing Sources**

	<b>Subcategory</b>	<b>Site</b>	<b>Firm</b>
<b>Direct Impacts</b>			
Site Closures/ Corporate Financial Distress	1	1	1 or more
Direct Employment Losses	# 500	# 500	\$14,000
<b>Community Impacts: Increase in Local Unemployment Rates</b>			
Percentage Points	0.6	0.6	# 0.1 to 2.1
<b>National Direct and Indirect Impacts</b>			
Employees	# 500	# 500	
Output (\$ millions)	\$60	\$60	

## **6.2 NEW SOURCE PERFORMANCE STANDARDS (NSPS) AND PRETREATMENT STANDARDS FOR NEW SOURCES (PSNS)**

The technology options EPA considered for new sources are identical to those it considered for existing dischargers. Engineering analysis indicates that the cost of installing pollution control systems during new construction is less than the cost of retrofitting existing facilities. Because EPA projects the costs for new sources to be less than those for existing sources and limited or no impacts are projected for existing sources, EPA expects no significant economic impacts for new sources. Because EPA projects no impacts for new sources, the regulation cannot be considered a barrier to entry.

Several technology options are zero discharge. All existing non-recovery cokemaking sources currently meet a zero discharge requirement; hence no impacts or barriers to entry are projected to occur for new sources. For non-integrated steelmaking and hot-forming operations, EPA added a zero discharge option. EPA believes the zero discharge new source option would not present a barrier to entry because, as of 1997, a total of 24 nonintegrated facilities of all types have been able to achieve zero discharge.

## **6.3 REFERENCES**

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## **CHAPTER 7**

### **SMALL BUSINESS ANALYSIS**

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 et seq., Public Law 96-354) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) (Public Law 104-121) requires agencies to analyze how a regulation will affect small entities. The purpose of the RFA is to establish as a principle of regulation that agencies should tailor regulatory and informational requirements to the size of entities, consistent with the objectives of a particular regulation and applicable statutes. If, based on an initial assessment, a proposed regulation is likely to have a significant economic impact on a substantial number of small entities, the RFA requires an initial regulatory flexibility analysis.<sup>1</sup> The requirement to prepare an initial regulatory flexibility analysis does not apply to a proposed rule if the head of the agency certifies that the proposal will not, if promulgated, have a significant impact on a substantial number of small entities.

EPA performed an initial assessment and a small business analysis of impacts. The first steps in an initial assessment are presented in Section 7.1. Section 7.2 describes the methodology for the small business analysis and Section 7.3 presents the results of the analysis.

#### **7.1 INITIAL ASSESSMENT**

EPA guidance on implementing RFA requirements suggests the following must be addressed in an initial assessment (EPA, 1999). First, EPA must indicate whether the proposal is a rule subject to notice-and-comment rulemaking requirements. EPA has determined that proposed effluent limitations guidelines and standards regulations are subject to notice-and-comment rulemaking requirements. Second, EPA should develop a profile of the affected small entities. EPA has developed a profile of the affected universe of entities—both large and small—in Chapter 2. Section 7.2 describes the data and procedures that EPA used to identify the number of small entities and estimate the number of sites owned by small entities. Third, EPA needs to determine whether the rule would affect small entities, have an adverse economic impact on small entities, and determine whether the rule would have a significant impact on a substantial number of small

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<sup>1</sup> The preparation of an initial regulatory flexibility analysis for a proposed rule does not legally foreclose certifying no significant impact for the final rule (EPA, 1999).

entities. Chapter 4 presents the economic methodology while Section 7.3 summarizes the findings for small entities.

## **7.2 SMALL BUSINESS IDENTIFICATION**

### **7.2.1 Classification**

The Small Business Administration (SBA) sets size standards to define whether a business entity is small and publishes these standards in 13 CFR 121. The standards are based either on the number of employees or receipts. Prior to 1 October 2000, SBA set size standards according to the Standard Industrial Classification (SIC) system. Accordingly, the EPA survey requested the respondents to identify different levels in site's corporate hierarchy by SIC code. The rule, however, will be proposed after 1 October 2000 when SBA will identify size standards according to the North American Industry Classification System (NAICS; FR, 1999). EPA examined both classification systems when identifying sites owned by small entities. The remaining subsections walk the reader through the methodology steps to identify small entities in the iron and steel industry.

#### ***7.2.1.1 SBA Guidance***

When making classification determinations, SBA counts receipts or employees of the entity and all of its domestic and foreign affiliates (13 CFR.121.103(a)(4)). SBA considers affiliations to include:

- # stock ownership or control of 50 percent or more of the voting stock or a block of stock that affords control because it is large compared to other outstanding blocks of stock (13 CFR 121.103(c)).
- # common management (13 CFR 121.103(e)).
- # joint ventures (13 CFR 121.103(f)).

EPA interprets this information as follows:

- # Sites with foreign ownership are not small (regardless of the number of employees or receipts at the domestic site).
- # The definition of small is set at the highest level in the corporate hierarchy and includes all employees or receipts from all members of that hierarchy.
- # If any one of a joint venture's affiliates is large, the venture cannot be classified as small. EPA determined ownership from survey responses and determined affiliates not specified in the survey from secondary sources. Corporate ownership of sites in the iron and steel database is based on January 2000.

#### ***7.2.1.2 Data Used for Business Size Classification***

EPA requested the respondent to identify the SIC code for the site, business entity that owns the site, and the corporate parent that owned the business entity (or for as many levels in the corporate hierarchy that exist). Determining the level in the corporate hierarchy at which to define whether a business entity is a small business is site-by-site assessment because, in some cases, the respondent entered the number of employees literally at the corporate headquarters and not for the entire company. The guidelines used to determine the level in the corporate hierarchy by which to classify the site is summarized here:

- # If a corporate parent exists,
  - If it is foreign, classify the site as such and remove from further analysis.
  - If the parent's classification depends on the number of employees and the number for the parent exceeds that for the company, use the parent's data for classification.
  - If the parent's classification depends on revenues, use the parent's data for classification.
  - If none of the above applies to the site, use the company information for classification.
- # If a site is a joint entity,
  - If any of the joint owners is a large business, classify the site as such and remove from further analysis.
  - If any of the joint entity partners are foreign, remove from further consideration.
- # At the company level,
  - If it is foreign, classify as such and remove from further consideration.

- If a company's classification depends on the number of employees and the number of employees is the same as or exceeds that for the site, use the company's data for classification.
  - If a company's classification is determined by revenues, use the company's data for classification.
- # If the site is the company, no other levels in the hierarchy exist, the site data are used for classification.

### ***7.2.1.3 SIC Codes Reported in EPA Survey***

Table 7-1 is a summary of the 28 4-digit SIC codes in EPA Survey data listed for the level at which the size classification is made. Although the sampling frame for the EPA Survey focused on four SIC codes: 3312, 3315, 3316, and 3317, the SIC codes extend beyond iron and steel operations because corporate parents hold operations in other sectors.

Several sites appear to be classified at the industry group level (3-digit code) and one site is classified at the major group level (2-digit code). Entries with a final zero are presumed to be classified at the 3-digit level (e.g., 1520, 2870, 3310, 3370, 3440, 3470, and 3490) and an entry with a final double zero is assumed to be classified at the 2-digit level (i.e., 3300).

Several of the 4-digit SIC codes provided by the respondents, however, do not exist in the 1987 SIC classification Manual (i.e., 1516, 2998, and 6749). For these sites, EPA classified the site at the 2- or 3- digit level. Table 7-1 lists the standards for each SIC code used in the small business analysis.

### ***7.2.1.4 Updated Site Ownership Information***

EPA searched secondary data to verify corporate ownership for each site and updated ownership to January 2000. The supporting material is in the rulemaking record.

**Table 7-1**  
**SIC Codes in Iron and Steel Database**

SIC Code	Short Name	Size Standard*	Short	Detailed	
				Parent	Company
1221	Bituminous Coal and Lignite Surface Mining	500			x
1516	15:Building Construction-General Contractors and Operative Builders	\$17			x
1520	152: General Building Contractors-Residential Buildings	\$17		x	
2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments	750			x
2911	Petroleum Refining	1,500		x	
2998	299:Miscellaneous Products of Petroleum and Coal	500			x
3300	33: Primary Metal Industries	500	x		
3310	331: Steel Works, Blast Furnaces, and Rolling and Finishing Mills	1,000		x	x
3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	1,000	x	x	x
3315	Steel Wiredrawing and Steel Nails and Spikes	1,000			x
3316	Cold-Rolled Steel Sheet, Strip, and Bars	1,000	x	x	x
3317	Steel Pipe and Tubes	1,000	x	x	x
3321	Gray and Ductile Iron Foundries	500			x
3351	Rolling, Drawing, and Extruding of Copper	750	x		
3356	Rolling, Drawing, and Extruding of Nonferrous Metals, Except Copper and Aluminum	750			x
3370	33: Primary Metal Industries	500			x
3440	344: Fabricated Structural Metal Products	500		x	
3470	347: Coating, Engraving, and Allied Services	500	x		
3471	Electroplating, Plating, Polishing, Anodizing, and Coloring	500	x		x
3479	349: Coating, Engraving, and Allied Services, NEC	500	x		
3490	Miscellaneous Fabricated Metal Products	500	x		
3562	Ball and Roller Bearings	750			x
3674	Semiconductors and Related Devices	500		x	
4925	Mixed, Manufactured, or Liquefied Petroleum	\$5			x
5051	Metals Service Centers and Offices	100	x		x
5093	Scrap and Waste Materials	100			x
5153	Grain and Field Beans	100		x	
6749	67: Holding and Other Investment Offices	\$5		x	
Totals			10	10	15
					3

Notes: Standards are either the number of employees or millions of dollars in revenue.  
If 4-digit SIC code is not listed in Standard Industrial Classification Manual, 1987, size standard is taken from the 3-digit or 2-digit level.  
For SIC 3310, a size standard of 1,000 employees is used because all steel-related codes in the 331 industry group have a size standard of 1,000 employees is used. SIC 3313 has a different size standard but it excludes steel.

### **7.2.1.5 NAICS Standard**

The North American Industry Classification System (NAICS) replaces the Standard Industrial Classification (SIC) as of 1 January 1997. The Small Business Administration proposes to convert business size standards to NAICS effective 1 October 2000 (FR, 1999). Appendix B cross-references the SIC codes with the NAICS codes and size standards.

Table 7-2 is a subset of Appendix B, listing only those SIC codes that change size standards when considered under NAICS. The following industries are potentially affected by the shift:

- # SIC 4295 is part of NAICS 22121. The size standard changes from \$5 million to 500 employees.
- # Stand-alone coke ovens, formerly part of SIC 3312 (steel works, blast furnaces, and rolling mills), are now classified in NAICS 324199. The size standard replaces 1,000 employees with 500 employees.
- # SIC 2865 is divided between NAICS 32511 and 325132. If the company shifts to the first NAICS category, the size standard changes from 750 to 1,000 employees.
- # SIC 3399, with a size standard of 750 employees- is split among four NAICS categories: 331111, 331492, 332618, and 332813. Only the first and last categories concern steel. If the company shifts to NAICS 331111, the size standard becomes 1,000 employees. If the company shifts to NAICS 332813, the size standard becomes 500 employees.
- # SIC 3315 is split between NAICS 33122 and 332618. If the company shifts to the second NAICS category, the size standard changes from 1,000 to 500 employees.
- # SIC 3699- with a size standard of 750 employees- is split among NAICS categories 333319 and 333618. If the company shifts to the first category, the size standard becomes 500 employees. If the company shifts to the second category, the size standard becomes 1,000 employees.

EPA examines each site whose company's status could change as a result of the shift from SIC to NAICS. No site changed classifications with the shift from SIC to NAICS.

**Table 7-2**  
**Cross-reference Between NAICS and SIC Codes**  
**Size Standard Changes**

<b>1997 NAICS code</b>	<b>1997 NAICS industry description</b>	<b>New, Existing or Revised Industry</b>	<b>Proposed size standard (\$ million or emp #) for NAICS industry</b>	<b>Existing size standard (\$ million or emp #) for SIC activity</b>	<b>1987 SIC code (* = part of SIC code)</b>	<b>1987 SIC industry</b>
<b>Sector 22 -- Utilities</b>						
<b>Subsector 221 -- Utilities</b>						
<b>22121</b>	<b>Natural Gas Distribution</b>	<b>R</b>	<b>500</b>	<b>\$5.0</b>	<b>*4923</b>	<b>Natural Gas Transmission and Distribution (distribution)</b>
				<b>500</b>	<b>4924</b>	<b>Natural Gas Distribution</b>
				<b>\$5.0</b>	<b>4925</b>	<b>Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Distribution (natural gas distribution)</b>
				<b>\$5.0</b>	<b>*4931</b>	<b>Electronic and Other Services Combined (natural gas distribution)</b>
				<b>\$5.0</b>	<b>4932</b>	<b>Gas and Other Services combined (natural gas distribution)</b>
				<b>\$5.0</b>	<b>*4939</b>	<b>Combination Utilities, NEC (natural gas distribution)</b>
<b>Subsector 324 -- Petroleum and Coal Products Manufacturing</b>						
<b>324199</b>	<b>All Other Petroleum and Coal Products Manufacturing</b>	<b>R</b>	<b>500</b>	<b>500</b>	<b>2999</b>	<b>Products of Petroleum and Coal, NEC</b>
				<b>1,000</b>	<b>*3312</b>	<b>Blast Furnaces and Steel Mills (coke ovens)</b>

<b>1997 NAICS code</b>	<b>1997 NAICS industry description</b>	<b>New, Existing or Revised Industry</b>	<b>Proposed size standard (\$ million or emp #) for NAICS industry</b>	<b>Existing size standard (\$ million or emp #) for SIC activity</b>	<b>1987 SIC code (* = part of SIC code)</b>	<b>1987 SIC industry</b>
<b>Subsector 325 -- Chemical Manufacturing</b>						
<b>32511</b>	<b>Petrochemical Manufacturing</b>	<b>N</b>	<b>1,000</b>	<b>750</b>	<b>*2865</b>	<b>Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (aromatics)</b>
				<b>1,000</b>	<b>*2869</b>	<b>Industrial Organic Chemicals, NEC (aliphatics)</b>
<b>25132</b>	<b>Synthetic Organic Dye and Pigment Manufacturing</b>	<b>N</b>	<b>750</b>	<b>750</b>	<b>*2865</b>	<b>Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (organic dyes and pigments)</b>
<b>Subsector 331 -- Primary Metal Manufacturing</b>						
<b>331111</b>	<b>Iron and Steel Mills</b>	<b>N</b>	<b>1,000</b>	<b>1,000</b>	<b>*3312</b>	<b>Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills (except coke ovens not integrated with steel mills)</b>
				<b>750</b>	<b>*3399</b>	<b>Primary Metal Products, NEC (ferrous powder, paste, flakes, etc.)</b>
<b>331222</b>	<b>Steel Wire Drawing</b>	<b>R</b>	<b>1,000</b>	<b>1,000</b>	<b>*3315</b>	<b>Steel Wiredrawing and Steel Nails and Spikes (steel wire drawing)</b>
<b>331492</b>	<b>Secondary Smelting, Refining, and Allying of Nonferrous Metal (except Copper and Aluminum)</b>	<b>N</b>	<b>750</b>	<b>750</b>	<b>*3313</b>	<b>Electrometallurgical Products, Except Steel (except Copper and Aluminum)</b>

<b>1997 NAICS code</b>	<b>1997 NAICS industry description</b>	<b>New, Existing or Revised Industry</b>	<b>Proposed size standard (\$ million or emp #) for NAICS industry</b>	<b>Existing size standard (\$ million or emp #) for SIC activity</b>	<b>1987 SIC code (* = part of SIC code)</b>	<b>1987 SIC industry</b>
				<b>500</b>	<b>*3341</b>	<b>Secondary Smelting and Reining of Nonferrous Metals (except Copper and Aluminum)</b>
				<b>750</b>	<b>*3399</b>	<b>Primary Metal Products, NEC (except Copper and Aluminum)</b>
<b>Subsector 332 - Fabricated Metal Product Manufacturing</b>						
				<b>500</b>	<b>*3499</b>	<b>Fabricated Metal Products, NEC (safe and vault locks)</b>
<b>332618</b>	<b>Other Fabricated Wire Product Manufacturing</b>	<b>R</b>	<b>500</b>	<b>1,000</b>	<b>*3315</b>	<b>Steel Wiredrawing and Steel Nails and Spikes (nails, spikes, paper clips and wire not made in wiredrawing plants)</b>
				<b>750</b>	<b>*3399</b>	<b>Primary Metal Products, NEC (nonferrous nails, brads, staples, etc.)</b>
				<b>500</b>	<b>3496</b>	<b>Miscellaneous Fabricated Wire Products</b>
<b>332813</b>	<b>Electroplating, Plating, Polishing, Anodizing and Coloring</b>	<b>R</b>	<b>500</b>	<b>750</b>	<b>*3399</b>	<b>Primary Metal Products, NEC (laminating steel)</b>
				<b>500</b>	<b>3471</b>	<b>Electroplating, Plating, Polishing, Anodizing, and Coloring</b>

<b>1997 NAICS code</b>	<b>1997 NAICS industry description</b>	<b>New, Existing or Revised Industry</b>	<b>Proposed size standard (\$ million or emp #) for NAICS industry</b>	<b>Existing size standard (\$ million or emp #) for SIC activity</b>	<b>1987 SIC code (* = part of SIC code)</b>	<b>1987 SIC industry</b>
<b>Subsector 333 -- Machinery Manufacturing</b>						
<b>333319</b>	<b>Other Commercial and Service Industry Machinery Manufacturing</b>	<b>R</b>	<b>500</b>	<b>500</b>	<b>*3559</b>	<b>Special Industry Machinery, NEC (automotive maintenance equipment)</b>
				<b>500</b>	<b>3589</b>	<b>Service Industry Machinery, NEC</b>
				<b>500</b>	<b>*3599</b>	<b>Industrial and Commercial Machinery and Equipment, NEC (carnival amusement park equipment)</b>
				<b>750</b>	<b>*3699</b>	<b>Electrical Machinery, Equipment and Supplies, NEC (electronic teaching machines and flight simulators)</b>
<b>333618</b>	<b>Other Engine Equipment Manufacturing</b>	<b>R</b>	<b>1,000</b>	<b>1,000</b>	<b>*3519</b>	<b>Internal Combustion Engines, NEC (except stationary engine radiators)</b>
				<b>750</b>	<b>*3699</b>	<b>Electrical Machinery, Equipment and Supplies, NEC (outboard electric motors)</b>

Source: Federal Register, 22 October 1999

### **7.2.2 Number of Small Entities**

EPA evaluates the number of small entities as the number of sites belonging to small businesses. EPA conducted a survey, not a census, of the iron and steel industry. That is, the Agency sent questionnaires to some but not all sites in the iron and steel industry. Because EPA drew the sample on the basis of site characteristics, the Agency could develop statistical weights for sites but not for companies.

EPA identified 115 companies in the survey of which 34 are small. Based on the statistical weights for the sites owned by these companies, EPA estimates that approximately 60 sites nationwide are owned by small entities. Because the number of companies cannot exceed the number of sites, the approach is conservative.

## **7.3 IMPACTS ON SITES OWNED BY SMALL ENTITIES**

### **7.3.1 Subcategory Impacts—Site Closure**

Section 6.1 summarizes the impacts by subcategory. Cokemaking BAT Options 3 and 4 each lead to the closure of one site owned by a small company. No closures, large or small, are seen with any other subcategory costs.

### **7.3.2 Site Cost Impacts—Site Closure**

EPA is co-proposing two sets of regulatory options (see Chapter 5 for description). Both sets include Cokemaking BAT Option 3, hence one site closure owned by a small company is incurred under each set.

### **7.3.3 Corporate Financial Distress**

To avoid double-counting impacts, the results of the pre-regulatory site closure analysis take precedence over the company analysis, see Section 4.4, footnote 8. No small entities move into financial distress as a result of either set of co-proposed options.

### **7.3.4 Compliance Cost Share of Revenue**

The Agency evaluated the annualized compliance cost as a percentage of 1997 revenue. Over two-thirds of the small entities incur **no** costs under either proposed option. The projected annualized compliance costs to revenue shares range from 0 percent to 1.59 percent for proposed option set A and from 0 to 1.91 percent for proposed option set B. Two and three firms incur costs in excess of 1 percent of revenues under co-proposed option set A and B, respectively.

### **7.3.5 Summary**

EPA examined the impacts of subcategory and site costs on sites owned by small entities and of aggregate site costs on small firms. EPA found one site owned by a small entity closed under both co-proposed option sets. No small firm is projected to incur financial distress as a result of either co-proposed option sets. EPA then evaluated the compliance cost share of revenue to identify any other potentially significant impacts and found the shares range from 0 percent to 1.59 percent for proposed option set A and from 0 to 1.91 percent for proposed option set B. Further, only two and three firms incur costs in excess of 1 percent of revenues under co-proposed option set A and B, respectively. As a result of the analyses, EPA has determined that the proposed rule does not impose a significant impact on a substantial number of small entities.

## **7.4 REFERENCES**

FR. 1999. Small Business Administration. 13 CFR Part 121. Small business size regulations; size standards and the North American Industry Classification System. Proposed Rule. *Federal Register* 64:57188-57286. 22 October 1999.

## **CHAPTER 8**

### **ENVIRONMENTAL BENEFITS**

#### **8.1 OVERVIEW**

An environmental assessment quantifies the water quality-related benefits associated with achievement of the Best Available Technology (BAT) and Pretreatment Standards for Existing Sources (PSES) proposed by the U.S. Environmental Protection Agency (EPA) to regulate iron and steel facilities (EPA, 2000; summarized here). Using site-specific analyses of current conditions and changes in discharges associated with the proposed regulation, EPA estimated in-stream pollutant concentrations for 60 priority and nonconventional pollutants from direct and indirect discharges in seven industry subcategories (cokemaking, steel finishing, nonintegrated steelmaking and hot forming, integrated and stand-alone hot forming, ironmaking, integrated steelmaking, and other) using stream dilution modeling.

EPA assessed the potential impacts and benefits to aquatic life by comparing the modeled in-stream pollutant concentrations to published EPA aquatic life criteria guidance or to toxic effect levels (Section 8.2). EPA projected potential adverse human health effects and benefits by (1) comparing estimated in-stream concentrations to health-based water quality toxic effect levels or criteria, (2) estimating the potential reductions of carcinogenic risk and noncarcinogenic hazard (systemic) from consuming contaminated fish or drinking water, and (3) estimating the potential reductions of lead exposure from consuming contaminated fish (Section 8.3).

The assessment estimated upper-bound individual cancer risks, population risks, and systemic hazards using modeled in-stream pollutant concentrations and standard EPA assumptions. The assessment evaluated modeled pollutant concentrations in fish and drinking water to estimate cancer risk and systemic hazards among the general population (drinking water only), sport anglers and their families, and subsistence anglers and their families. The assessment also evaluated modeled pollutant concentrations in fish to estimate human health effects from exposure to lead among sport anglers and their families, and subsistence anglers and their families. EPA used the findings from the analyses of reduced occurrence of in-stream pollutant concentrations in excess of both aquatic life and human health criteria or toxic effect levels to assess

improvements in recreational fishing habitats that are impacted by iron and steel wastewater discharges (ecological benefits; Section 8.4). EPA expects that these improvements in aquatic habitats will improve the quality and value of recreational fishing opportunities and nonuse (intrinsic) values of the receiving streams.

The assessment also evaluated potential inhibition of operations (i.e., inhibition of microbial degradation processes) at publicly owned treatment works (POTWs), and sewage sludge contamination (here defined as a sludge pollutant concentration in excess of that permitting land application or surface disposal of sewage sludge), at current and proposed pretreatment levels (Section 8.5). The assessment estimated inhibition of POTW operations by comparing modeled POTW influent concentrations to available inhibition levels. The assessment estimated contamination of sewage sludge by comparing projected pollutant concentrations in sewage sludge to available EPA regulatory standards for land application and surface disposal. EPA based estimates of economic productivity benefits, if applicable, on the incremental quantity of sludge that, as a result of reduced pollutant discharges to POTWs, meets criteria for the generally less expensive disposal method, namely land application and surface disposal.

In addition, this report presents the potential fate and toxicity of pollutants of concern associated with iron and steel wastewater on the basis of known characteristics of each chemical (Section 8.6). The report also includes reviews of recent reports and databases that provide evidence of documented environmental impacts on aquatic life, human health, and the quality of receiving water (Section 8.7).

The assessment included analyses of discharges from representative sample sets of the 150 iron and steel facilities (103 direct dischargers and 47 indirect dischargers) identified as being within the scope of this proposed regulation. EPA extrapolated results, where applicable, to the national level using the statistical methodology for estimating costs, loads, and economic impacts. This report provides the results of those analyses, organized by the type of discharge (direct and indirect). Section 8.8 summarizes the findings.

## **8.2 COMPARISON OF IN-STREAM CONCENTRATIONS WITH AMBIENT WATER QUALITY CRITERIA (AWQC) AND IMPACTS AT POTWS**

### **8.2.1 Direct Discharging Facilities**

#### ***8.2.1.1 Sample Set***

The water quality modeling results for 103 iron and steel facilities directly discharging 60 pollutants to 77 receiving streams indicate that—at current discharge levels—in-stream concentrations of 7 pollutants will exceed acute aquatic life criteria or toxic effect levels in 25 percent of the receiving streams (19 of the total 77). The analysis projects that modeled in-stream concentrations of 16 pollutants will exceed chronic aquatic life criteria or toxic effect levels in 48 percent of the receiving streams (37 of the total 77). The proposed iron and steel guidelines will reduce acute aquatic life excursions to 3 pollutants in 17 percent of the receiving streams (13 of the total 77) and chronic aquatic life excursions to 12 pollutants in 40 percent of the receiving streams (31 of the total 77). Additionally, the analysis projects that the modeled in-stream concentrations of 12 pollutants at current and 11 pollutants at proposed BAT discharge levels (using a target risk of  $10^{-6}$  (1E-6) for carcinogens) will exceed human health criteria or toxic effect levels (developed for consumption of water and organisms) in 35 percent (27 of the total 77) and 25 percent (19 of the total 77) of the receiving streams, respectively. It also projects that the modeled in-stream concentrations of 6 pollutants (using a target risk of  $10^{-6}$  (1E-6) for carcinogens) will exceed the human health criteria or toxic effect levels (developed for consumption of organisms only) in 21 percent of the receiving streams (16 of the total 77) at current discharge levels. The proposed iron and steel guidelines will eliminate excursions of the human health criteria or toxic effect levels (developed for consumption of organisms only) in 3 of the receiving streams. The proposed guidelines also will reduce pollutant loadings by 23 percent.

#### ***8.2.1.2 National Extrapolation***

Extrapolation of the modeling results of the sample set yields 131 iron and steel facilities discharging 60 pollutants to 100 receiving streams. The analysis projects that extrapolated in-stream pollutant concentrations will exceed acute aquatic life criteria in 23 percent of the receiving streams (23 of the total 100) at current discharge levels. The proposed regulation will reduce excursions to 16 percent of the receiving streams (16 of the total 100). The analysis projects that extrapolated in-stream pollutant

concentrations will exceed chronic aquatic life criteria in 47 percent (47 of the total 100) and 41 percent (41 of the total 100) of the receiving streams at current and proposed BAT discharge levels, respectively. Additionally, the analysis projects that extrapolated in-stream pollutant concentrations will exceed human health criteria or toxic effect levels (developed for consumption of water and organisms) in 30 percent of the receiving streams (30 of the total 100) at current discharge levels and in 20 percent of the receiving streams (20 of the total 100) at proposed BAT discharge levels. The analysis projects excursions of human health criteria or toxic effect levels (developed for consumption of organisms only) in 17 percent of the receiving streams (17 of the total 100) at current discharge levels. The proposed iron and steel guidelines will reduce the excursions of human health criteria or toxic effect levels (developed for consumption of organisms only) from 17 to 14 receiving streams. The proposed guidelines also will reduce pollutant loadings by 23 percent.

## **8.2.2 Indirect Discharging Facilities**

### ***8.2.2.1 Sample Set***

The water quality modeling results for 47 indirect iron and steel facilities discharging 56 pollutants to 43 POTWs located on 43 receiving streams indicate that at current and proposed PSES discharge levels, in-stream pollutant concentrations will not exceed acute aquatic life criteria or toxic effect levels. Because the analysis projects no excursions, EPA does not extrapolate these results to the national level. The analysis does project that modeled in-stream concentrations of 2 pollutants at current discharge levels will exceed chronic aquatic life criteria in 7 percent of the receiving streams (3 of the total 43). The proposed iron and steel guidelines will reduce excursions of the 2 pollutants to 2 receiving streams. Additionally, the analysis projects that modeled in-stream pollutant concentrations (using a target risk of  $10^{-6}$  (1E-6) for carcinogens) will not exceed human health criteria or toxic effect levels (developed either for the consumption of water and organisms or for the consumption of organisms only). Therefore, EPA does not extrapolate these results to the national level. The proposed iron and steel guidelines also will reduce pollutant loadings by 6 percent.

In addition, the analysis evaluates impacts on POTW operations and contamination of POTW sludges. The analysis projects that no inhibition of POTW operations or sludge contamination problems will occur at any of the POTWs. Because the analysis projects no impacts at POTWs, EPA does not extrapolate these results to the national level.

### **8.2.2.2 National Extrapolation**

Extrapolating the modeling results of the sample set yields 67 iron and steel facilities discharging 56 pollutants to 61 POTWs with outfalls on 61 receiving streams.<sup>1</sup> The analysis projects that extrapolated in-stream pollutant concentrations will exceed only chronic aquatic life criteria or toxic effect levels in 7 percent of the receiving streams (4 of the total 61) at current discharge levels. The iron and steel proposed guidelines will eliminate excursions in 2 of the 4 receiving streams at proposed PSES discharge levels. The proposed guidelines also will reduce pollutant loadings by 6 percent.

## **8.3 HUMAN HEALTH RISKS AND BENEFITS**

### **8.3.1 Direct Discharging Facilities**

Projections for the sample set show that the proposed iron and steel guidelines will reduce total excess annual cancer cases from the ingestion of contaminated fish by 1.0E-2 cases. The monetary value of benefits to society from these avoided cancer cases ranges from \$24,000 to \$126,000 (1997 dollars). Results, extrapolated to the national level, project a reduction of 2.0E-2 excess annual cancer cases and monetized benefits ranging from \$48,000 to \$252,000 (1997 dollars). The analysis projects that no excess annual cancer cases will result from the consumption of contaminated drinking water. In addition, using the estimated hazard calculated for each receiving stream, the analysis projects that the proposed guidelines will eliminate the hazard to approximately 900 subsistence anglers and their families potentially exposed to systemic toxicant effects from contaminated fish for both the sample set and the national extrapolation of iron and steel facilities. The analysis projects no systemic toxicant effects from exposure to contaminated drinking water.

Projections for the sample set also show that the proposed guidelines will reduce the ingestion of lead-contaminated fish by children (ages 0-6) of sport and subsistence anglers at 39 receiving streams. The analysis projects a potentially exposed population of 15,000 children. The monetary value of benefits to society from avoided loss of IQ points (55.83 points) is \$542,000 (1997 dollars). Results, extrapolated to the

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<sup>1</sup>The national estimate for the number of iron and steel sites potentially affected by the proposed regulation is 254 with 56 zero discharge sites, see Chapter 3.

national level, project reductions for a potentially exposed population of 17,000 children at 46 receiving streams, with monetary benefits from avoided loss of IQ points (57.26 points) estimated at \$556,000 (1997 dollars). Additionally, ingestion of lead-contaminated fish by adult sport and subsistence anglers is reduced at 55 receiving streams. The analysis projects a potentially exposed population of 371,000 adults and neonates. Based on the reductions in blood pressure (0.035 cases), as it relates to adult and neonatal premature mortality, the monetary benefits to society from avoided mortality ranges from \$83,000 to \$435,000 (1997 dollars). Results, extrapolated to the national level, project reductions (0.036 cases) for a potentially exposed population of 388,000 adults and neonates at 68 receiving streams, with monetary benefits estimated from \$86,000 to \$451,000 (1997 dollars).

### **8.3.2 Indirect Discharging Facilities**

Projections for the sample set show that the proposed iron and steel guidelines will reduce total excess annual cancer cases from the ingestion of contaminated fish by  $3.0\text{E-}6$  cancer cases. The monetary value of benefits to society from these avoided cancer cases is less than \$100 (1997 dollars). Results, extrapolated to the national level, project a similar reduction in excess annual cancer cases and similar monetized benefits. The analysis projects that no total excess annual cancer cases will result from the consumption of contaminated drinking water. Projections also indicate no systemic toxicant effects from the consumption of contaminated fish or drinking water.

Projections for the sample set also show that the proposed guidelines will reduce the ingestion of lead-contaminated fish by children (ages 0-6) of sport and subsistence anglers at 4 receiving streams. The analysis projects a potentially exposed population of 800 children. The monetary value of benefits to society from avoided loss of IQ points (0.026 points) is \$250 (1997 dollars). Results, extrapolated to the national level, project reductions for a potentially exposed population of 1,000 children at 5 receiving streams, with monetary benefits from avoided loss of IQ points (0.030 points) estimated at \$290 (1997 dollars). Additionally, the ingestion of lead-contaminated fish by adult sport and subsistence anglers is reduced at 24 receiving streams. The analysis projects a potentially exposed population of 352,000 adults and neonates. Based on the reductions in blood pressure ( $3.6\text{E-}5$  cases), as it relates to adult and neonatal premature mortality, the monetary benefits to society from avoided mortality ranges from \$85 to \$450 (1997 dollars). Results, extrapolated to the national level, project reductions ( $4.1\text{E-}5$  cases) for a potentially exposed

population of 542,000 adults and neonates at 37 receiving streams, with monetary benefits estimated from \$99 to \$520 (1997 dollars).

#### **8.4 ECOLOGICAL BENEFITS**

The analysis projects ecological benefits resulting from improvements in recreational fishing habitats for both direct and indirect wastewater discharges. According to the projections for the direct sample set, the proposed regulation will completely eliminate in-stream concentrations in excess of aquatic life and human health ambient water quality criteria (AWQC) in 2 streams receiving direct wastewater discharges. The analysis estimates the monetary value of improved recreational fishing opportunities by first calculating the baseline value of the receiving stream using a value per person-day of recreational fishing and the number of person-days fished on the receiving stream. It then calculates the value of improving water quality in this fishery, based on the increase in value to anglers of achieving contaminant-free fishing. The resulting estimate of the increase in value of recreational fishing to anglers on the 2 improved receiving streams ranges from \$107,000 to \$382,000 (1997 dollars). Results, extrapolated to the national level, project that the proposed regulation will completely eliminate in-stream concentrations in excess of AWQC at 2 receiving streams. The resulting estimate of the increase in value of recreational fishing to anglers ranges from \$109,000 to \$389,000 (1997 dollars). In addition, the estimate of the nonuse (intrinsic) benefits to the general public, as a result of the same improvements in water quality, ranges from at least \$53,500 to \$191,000 (1997 dollars). Results, extrapolated to the national level, project an increase in nonuse values ranging from \$54,500 to \$194,500 (1997 dollars). These nonuse benefits are estimated as one-half of the recreational benefits and may be significantly underestimated.

Projections for the indirect sample set indicate that the proposed regulation will completely eliminate in-stream concentrations in excess of aquatic life and human health AWQC in 1 receiving stream receiving indirect wastewater discharges. The resulting estimate of the increase in value of recreational fishing to anglers on the 1 improved receiving stream ranges from \$81,000 to \$289,000 (1997 dollars). Results, extrapolated to the national level, project that the final regulation will completely eliminate in-stream concentrations in excess of AWQC at 2 receiving streams. The resulting estimate of the increase in value of recreational fishing to anglers ranges from \$143,000 to \$511,000 (1997 dollars). In addition, the estimate of the nonuse (intrinsic) benefits to the general public, ranges from at least \$40,500 to \$144,500 (1997 dollars).

Results, extrapolated to the national level, project an increase in nonuse values ranging from \$71,500 to \$255,500 (1997 dollars). As with direct discharges, these nonuse benefits are estimated as one-half of the recreational benefits and may be significantly underestimated.

The estimated benefit of improved recreational fishery opportunities is only a limited measure of the value to society of the improvements in aquatic habitats expected to result from the regulation. Additional benefits, which cannot be quantified in this assessment, include increased assimilation capacity of the receiving stream, protection of terrestrial wildlife and birds that consume aquatic organisms, maintenance of an aesthetically pleasing environment, and improvements to other recreational activities such as swimming, water skiing, boating, and wildlife observation. Such activities contribute to the support of local and State economies.

## **8.5 ECONOMIC PRODUCTIVITY BENEFITS**

The analysis projects no potential economic productivity benefits from reduced sewage sludge contamination and sewage sludge disposal costs at the POTWs receiving iron and steel discharges. No sludge contamination problems are projected at any of the 43 POTWs receiving wastewater from 47 iron and steel facilities.

## **8.6 POLLUTANT FATE AND TOXICITY**

### **8.6.1 Direct Discharging Facilities**

EPA identified 70 pollutants of concern (28 priority pollutants, 4 conventional pollutants, and 38 nonconventional pollutants) in waste streams from direct discharging iron and steel facilities. EPA evaluates these pollutants to assess their potential fate and toxicity on the basis of known characteristics of each chemical.

Most of the 70 pollutants have at least one known toxic effect. Using available physical-chemical properties and aquatic life and human health toxicity data for these pollutants, the analysis determines that 23

exhibit moderate to high toxicity to aquatic life, 16 are classified as known or probable human carcinogens, 39 are human systemic toxicants, 23 have drinking water values, and 28 are designated by EPA as priority pollutants. In terms of projected partitioning among media, 16 of the evaluated pollutants are moderately to highly volatile (potentially causing risk to exposed populations via inhalation), 25 have a moderate to high potential to bioaccumulate in aquatic biota (potentially accumulating in the food chain and causing increased risk to higher trophic level organisms and to exposed human populations via consumption of fish and shellfish), 18 are moderately to highly adsorptive to solids, and 8 are resistant to biodegradation or are slowly biodegraded.

#### **8.6.2 Indirect Discharging Facilities**

EPA also identified 66 pollutants of concern (27 priority pollutants, 35 nonconventional pollutants, and 4 conventional pollutants) in waste streams from indirect discharging iron and steel facilities. EPA evaluates these pollutants to assess their potential fate and toxicity on the basis of known characteristics of each chemical.

Most of the 66 pollutants have at least one known toxic effect. Using available physical-chemical properties and aquatic life and human health toxicity data for these pollutants, the analysis determines that 22 exhibit moderate to high toxicity to aquatic life, 15 are classified as known or probable carcinogens, 38 are human systemic toxicants, 23 have drinking water values, and 27 are designated by EPA as priority pollutants. In terms of projected environmental partitioning among media, 16 of the evaluated pollutants are moderately to highly volatile, 22 have a moderate to high potential to bioaccumulate in aquatic biota, 16 are moderately to highly adsorptive to solids, and 8 are resistant to biodegradation or are slowly biodegraded.

Evaluations do not include the impacts of the 4 conventional and 6 nonconventional pollutants when modeling the effects of the proposed regulation on receiving stream water quality and POTW operations or when evaluating the potential fate and toxicity of discharged pollutants. These pollutants are total suspended solids (TSS), 5-day biological oxygen demand (BOD<sub>5</sub>), oil and grease (measured as hexane extractable material [HEM] and silica gel-treated HEM), chemical oxygen demand (COD), total organic carbon (TOC), total recoverable phenolics, total kjeldahl nitrogen, amenable cyanide, and weak acid dissociable cyanide. The discharge of these pollutants may adversely affect human health and the environment. For example, habitat

degradation may result from increased suspended particulate matter that reduces light penetration, and thus primary productivity, or from accumulation of sludge particles that alter benthic spawning grounds and feeding habitats. Oil and grease can have lethal effects on fish by coating the surface of gills and causing asphyxia, by depleting oxygen levels as a result of excessive BOD, or by reducing stream reaeration because of surface film. Oil and grease can also have detrimental effects on waterfowl by destroying the buoyancy and insulation of their feathers. Bioaccumulation of oily substances can cause human health problems including tainting of fish and bioaccumulation of carcinogenic polycyclic aromatic compounds. High COD and BOD<sub>5</sub> levels can deplete oxygen concentrations in water, which can result in mortality or other adverse effects in fish. High TOC levels may interfere with water quality by causing taste and odor problems in the water and mortality in fish.

## **8.7 DOCUMENTED ENVIRONMENTAL IMPACTS**

This assessment also summarizes documented environmental impacts on aquatic life, human health, and receiving stream water quality. The summaries are based on a review of reports, State 303(d) lists of impaired waterbodies, and State fishing advisories.

States identified at least 17 impaired waterbodies, with industrial point sources as a potential source of impairment, that receive direct discharges from iron and steel facilities (and other sources). States also issued fish consumption advisories for 12 waterbodies that receive direct discharges from iron and steel facilities (and other sources). The advisories are for mercury, an iron and steel pollutant of concern. Over 25 fish consumption advisories were issued for waterbodies that receive wastewater discharges from iron and steel facilities. However, the vast majority of advisories are for chemicals that are not pollutants of concern. In addition, EPA identified significant noncompliance (SNC) rates (most egregious violations under each program or statute) for iron and steel facilities. Of the 27 integrated mills inspected in fiscal years (FY) 1996 and 1997, 96 percent were out of compliance with one or more statutes, and 65 percent were in SNC. In FY 1998, of the 23 integrated mills inspected, 39.1 percent of the facilities were in SNC with their water permits, 72.7 percent with air violations, and 30.4 percent with Resource Conservation and Recovery Act (RCRA) violations. SNC rates for 91 mini-mills were 21.2 percent for air, 2.7 percent for water permits, and 4.5 percent for RCRA. Key compliance and environmental problems include groundwater contamination from slag disposal, contaminated sediments from steelmaking, electric arc furnace dust, unregulated sources, SNCs from recurring and single peak violations, and no baseline testing.

## **8.8 SUMMARY OF POTENTIAL EFFECTS/BENEFITS FROM PROPOSED EFFLUENT GUIDELINES**

EPA estimates that the annual monetized benefits resulting from the proposed effluent guidelines will range from \$1.07 million to \$2.61 million (1997 dollars). Table 8-1 summarizes these effects/benefits. The range reflects the uncertainty in evaluating the effects of this proposed rule and in placing a monetary value on these effects. The reported benefit estimate understates the total benefits expected to result under this proposed rule. Additional benefits, which cannot be quantified in this assessment include improved ecological conditions from improvements in water quality, improvements to other recreational activities, reduced noncarcinogenic (systemic) human health hazards, additional health benefits due to reduced lead exposure, reduced POTW costs, and reduced discharge of conventional and other pollutants.

## **8.9 REFERENCE**

EPA. 2000. Environmental Assessment of the Proposed Effluent Limitations Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category. U.S. Environmental Protection Agency. Washington, DC. EPA-821-B-00-009. October.

**Table 8-1**

**Summary of Potential Effects/Benefits from the  
Proposed Effluent Guidelines for the Iron and Steel Industry<sup>a</sup>  
(National Level)**

	<b>Current Discharge Levels</b>	<b>Proposed BAT/PSES Discharge Levels</b>	<b>Summary</b>
Loadings (million lbs/year) <sup>b</sup>	253.2	197.6	22 percent Reduction
Number of in-stream pollutant concentrations that exceed Ambient Water Quality Criteria (AWQC)	269 at 55 Receiving Streams	175 at 51 Receiving Streams	4 Streams Become “Contaminant Free” <sup>c</sup>  Recreational/Intrinsic Monetized Benefits = \$0.38 to \$1.35 million
Excess Annual Cancer Cases <sup>d</sup>	0.31	0.29	0.02 Cases Reduced Each Year  Monetized Benefits = \$0.05 to \$0.25 million
Population/Streams at Risk to Lead Exposure <sup>d</sup>	948,000 at 104 Receiving Streams	948,000 at 104 Receiving Streams	Annual Benefits: <ul style="list-style-type: none"> <li>• Reduction of 0.036 Cases of Premature Mortality</li> <li>• Prevention of 57 IQ Point Loss in children</li> </ul> Monetized Benefits = \$0.64 to \$1.01 million
Population Exposed to Systemic Effects <sup>d</sup>	900	0	Health Effects to Exposed Population are Reduced  Monetized Benefits = Unquantified
Total Monetized Benefits	–	–	\$1.07 - \$2.61 million (1997 dollars)

<sup>a</sup> Modeled results represent 131 direct facilities discharging 60 pollutants to 100 receiving streams and 67 indirect facilities discharging 56 pollutants to 61 POTWs with outfalls on 61 receiving streams.

<sup>b</sup> Loadings are representative of priority and nonconventional pollutants evaluated; 4 conventional and 6 nonconventional pollutants are not evaluated. Loadings account for POTW removals.

<sup>c</sup> “Contaminant free” from iron and steel discharges; however, potential contamination from other point sources and non-point sources is still possible.

<sup>d</sup> Based on exposure through consumption of contaminated fish tissue.

## **CHAPTER 9**

### **COST-BENEFIT COMPARISON AND UNFUNDED MANDATES REFORM ACT ANALYSIS**

#### **9.1 COST-BENEFIT COMPARISON**

The pre-tax annualized cost ranges from \$54.3 million to \$59 million for the co-proposed options. The pre-tax cost is a proxy for the social cost of the regulation because it incorporates the cost to industry (post-tax costs), and costs to State and Federal governments (i.e., lost income from tax shields).<sup>1</sup> In other words, the cost part of the equation is well-identified and estimated.

The estimated quantified and monetized benefits of the rule range from \$1.1 million to \$2.6 million. This, however, is an underestimate because EPA can fully characterize only a limited set of benefits to the point of monetization. Chapter 8 focuses mainly on identified compounds with quantifiable toxic or carcinogenic effects. This potentially leads to a large underestimation of benefits, since some significant pollutant characterizations are not considered. For example, the analyses do not include the benefits associated with reducing the particulate load (measured as TSS), or the oxygen demand (measured as BOD<sub>5</sub> and COD) of the effluents. TSS loads can degrade an ecological habitat by reducing light penetration and primary productivity, and from accumulation of solid particles that alter benthic spawning grounds and feeding habitats. BOD<sub>5</sub> and COD loads can deplete oxygen levels, which can produce mortality or other adverse effects in fish, as well as reduce biological diversity. Finally, the benefits estimates do not include improved POTW operations and reduced costs at POTWs. Therefore, the reported benefit estimate understates the total benefits of this proposed rule.

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<sup>1</sup>All sites are currently permitted and permits are reissued on a periodic basis, so incremental costs administrative costs of the regulation are negligible.

## 9.2 UNFUNDED MANDATES REFORM ACT ANALYSIS

Title II of the Unfunded Mandates Reform Act of 1995 (Public Law 104-4; UMRA) establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments as well as the private sector. Under Section 202(a)(1) of UMRA, EPA must generally prepare a written statement, including a cost-benefit analysis, for proposed and final regulations that “includes any Federal mandate that may result in the expenditure by State, local, and tribal governments, in the aggregate or by the private sector” of annual costs in excess of \$100 million.<sup>2</sup> As a general matter, a federal mandate includes Federal Regulations that impose enforceable duties on State, local, and tribal governments, or on the private sector (Katzen, 1995). Significant regulatory actions require Office of Management and Budget review and the preparation of a Regulatory Impact Assessment that compares the costs and benefits of the action.

The proposed iron and steel industry effluent limitations guidelines are not an unfunded mandate on state, local, or tribal governments because industry bears the cost of the regulation. The cost estimate to industry does not exceed \$100 million/year; hence, the proposed rule is not an unfunded mandate on industry. EPA, however, is responsive to all required provisions of UMRA. In particular, the Economic Analysis (EA) addresses:

- # Section 202(a)(1)—authorizing legislation (Section 1 and the preamble to the rule);
- # Section 202(a)(2)—a qualitative and quantitative assessment of the anticipated costs and benefits of the regulation, including administration costs to state and local governments (Sections 5 and 8);
- # Section 202(a)(3)(A)—accurate estimates of future compliance costs (as reasonably feasible; Section 5);
- # Section 202(a)(3)(B)—disproportionate effects on particular regions or segments of the private sector. EPA projects one iron and steel site to close as a result of the costs of the proposed combination of options and one large company to move into a financially distressed position but no disproportionate effects on a particular region or segments of the private sector (Chapter 6);
- # Section 202(a)(3)(B)—disproportionate effects on local communities. EPA projects one iron and steel site to close as a result of the costs of the proposed combination of options

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<sup>2</sup> The \$100 million in annual costs is the same threshold that identifies a “significant regulatory action” in Executive Order 12866.

and one large company to move into a financially distressed position but no disproportionate effects on local communities (Chapter 6) .

- # Section 202(a)(4)—estimated effects on the national economy (Chapter 6);
- # Section 205(a)—least burdensome option or explanation required (this Chapter).

The preamble to the proposed Rule summarizes the extent of EPA's consultation with stakeholders including industry, environmental groups, states, and local governments (UMRA, sections 202(a)(5) and 204).

Because this rule does not “significantly or uniquely” affect small governments, section 203 of UMRA does not apply.

Pursuant to section 205(a)(1)-(2), EPA has selected the “least costly, most cost-effective or least burdensome alternative” consistent with the requirements of the Clean Water Act (CWA) for the reasons discussed in the preamble to the rule. EPA is required under the CWA (section 304, Best Available Technology Economically Achievable (BAT), and section 307, Pretreatment Standards for Existing Sources (PSES)) to set effluent limitations guidelines and standards based on BAT considering factors listed in the CWA such as age of equipment and facilities involved, and processes employed. EPA is also required under the CWA (section 306, New Source Performance Standards (NSPS), and section 307, Pretreatment Standards for New Sources (PSNS)) to set effluent limitations guidelines and standards based on Best Available Demonstrated Technology. EPA determined that the rule constitutes the least burdensome alternative consistent with the CWA.

### **9.3 REFERENCES**

Katzen. 1995. Guidance for implementing Title II of S.I., Memorandum for the Heads of Executive Departments and Agencies from Sally Katzen, Ad, OIRA. March 31, 1995.